The Hard Realities of Earthquake Recovery: Christchurch, NZ – Two Years Later

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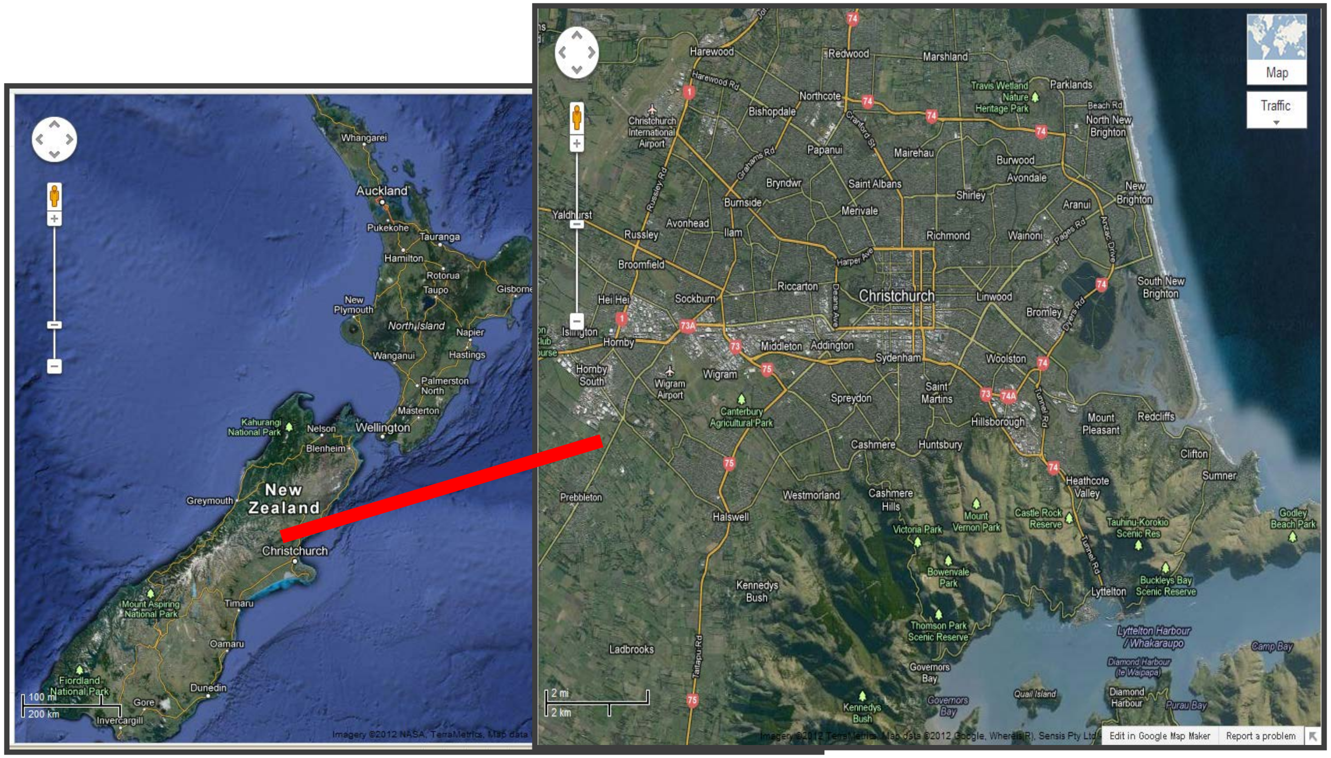
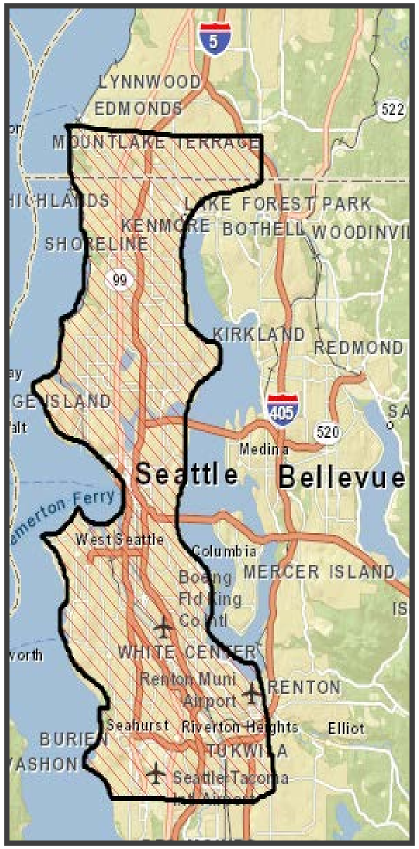
Overview: The Canterbury Earthquakes

Location & Demographics

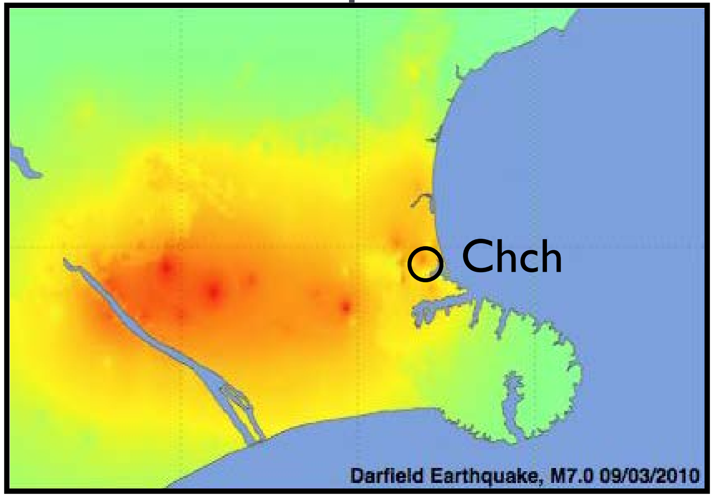




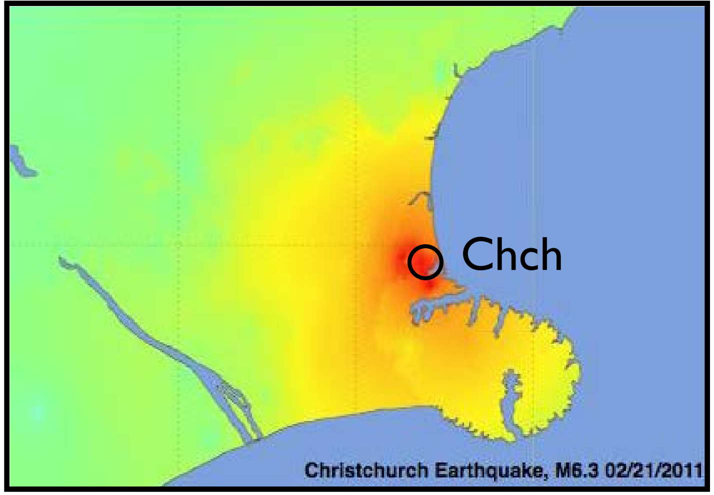
- Christchurch is the largest city on the south island of New Zealand
  - Pre-Earthquake Population: 359,900 (~68% the size of Seattle's Population)
  - 174 square miles (~the size of Mountlake Terrace to Sea-Tac Airport)
  - Founded in 1856 (Washington State admitted to Union in 1889) - Similar development histories
  - Seattle's Sister City since 1981

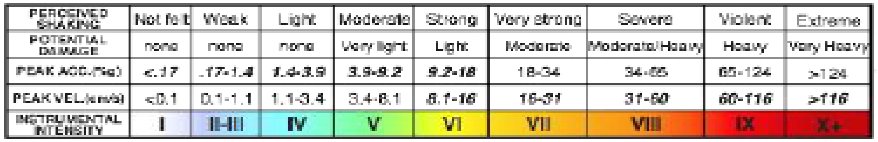
The Canterbury Earthquakes

- **September 4, 2010**
  - Magnitude 7.1
  - 25 miles west of Christchurch
  - 6 miles deep



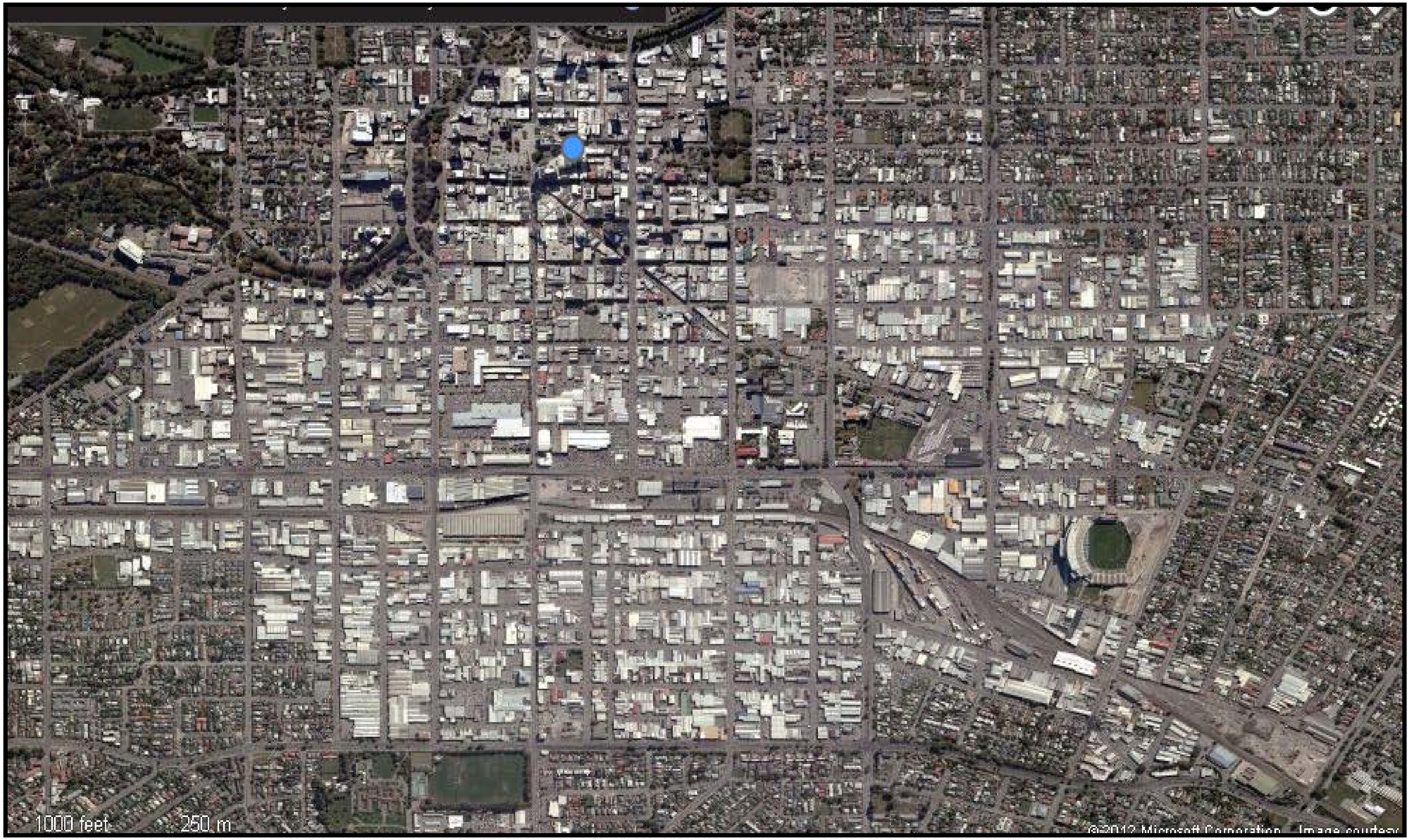
- **February 22, 2011**
  - Magnitude 6.3
  - 3 miles southwest of Christchurch
  - 3 miles deep



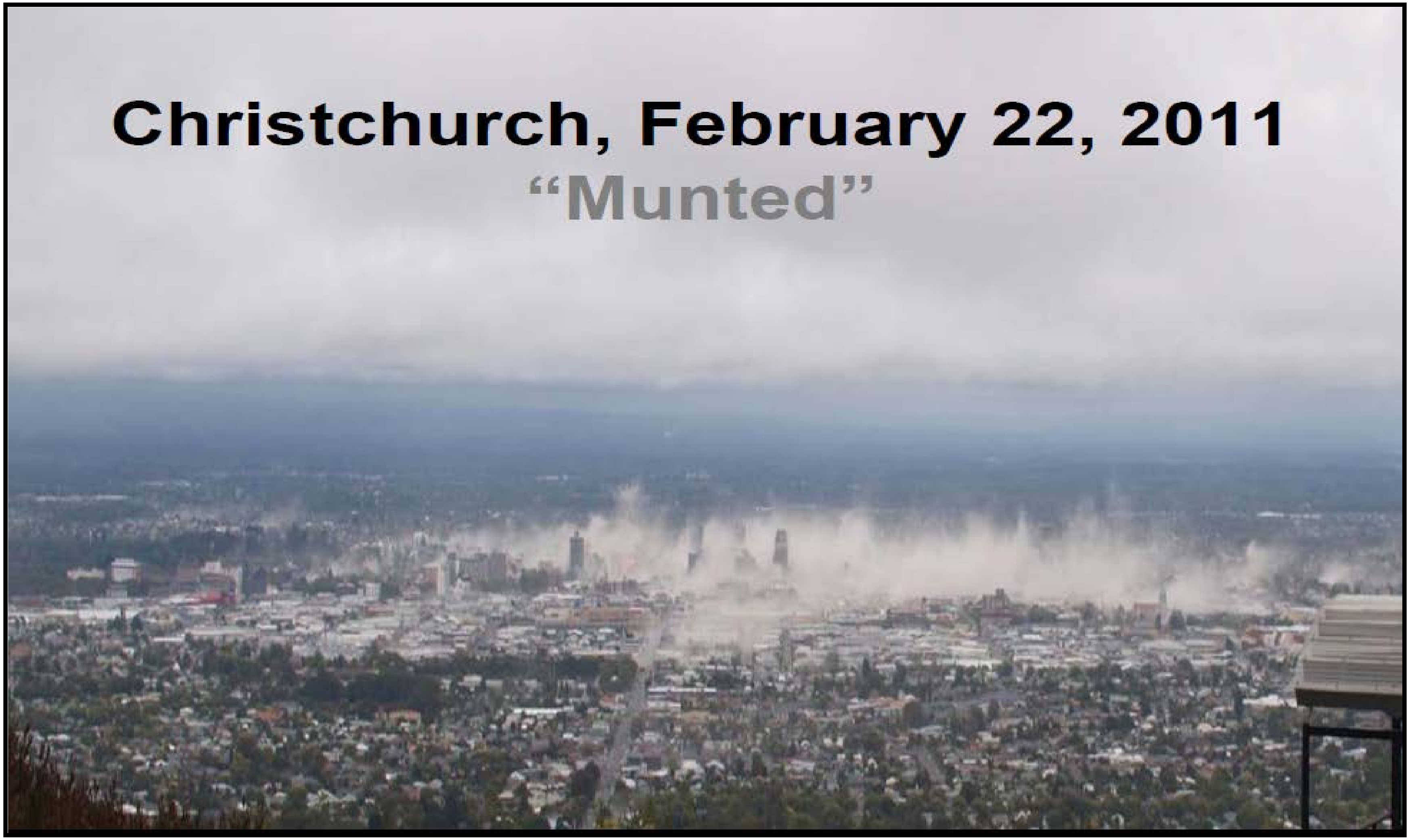


PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Pre-Earthquake:
Christchurch Central Business District (CBD)



During Earthquake:
Christchurch Central Business District



Post-Earthquake: (Recovery in Process) Christchurch Central Business District

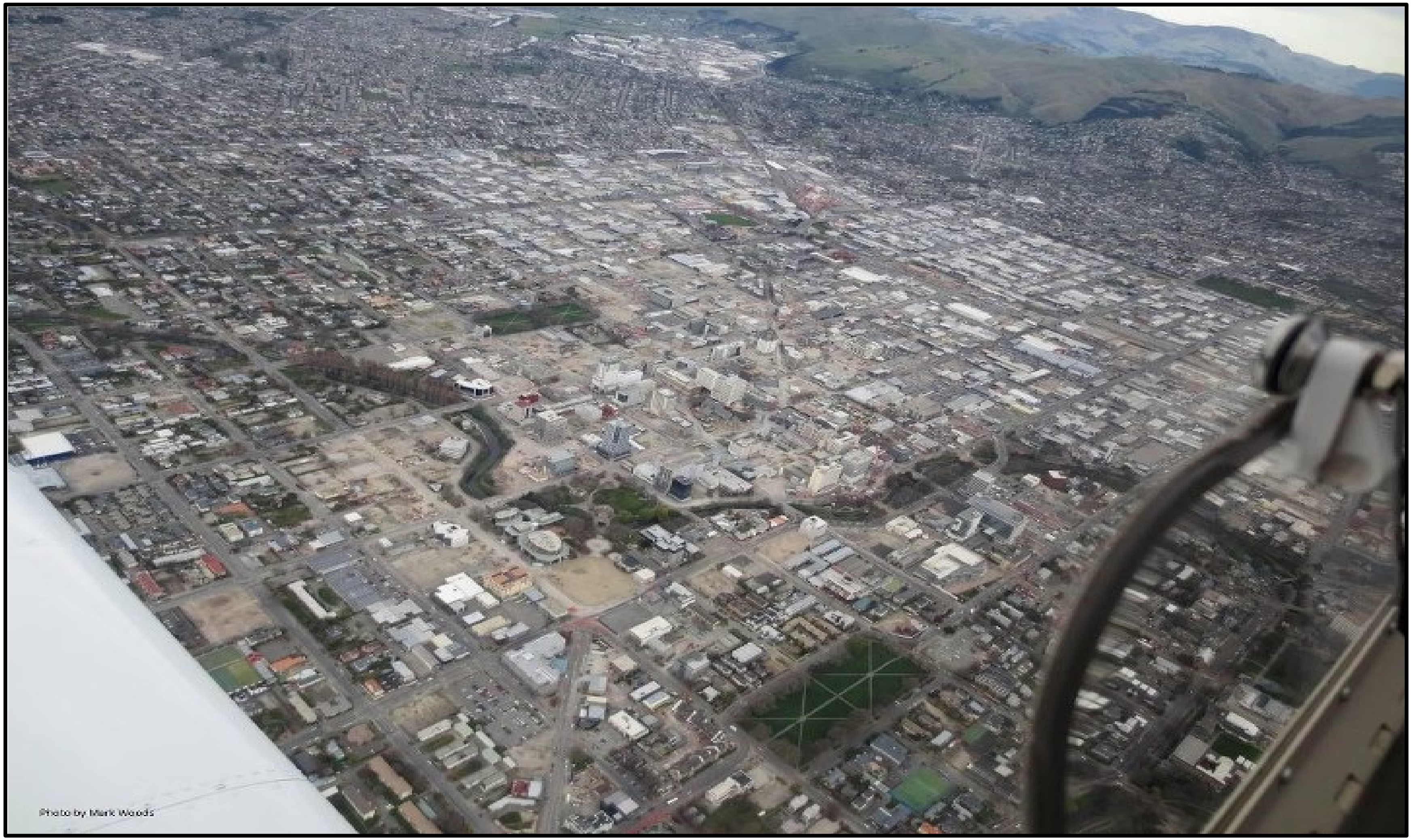
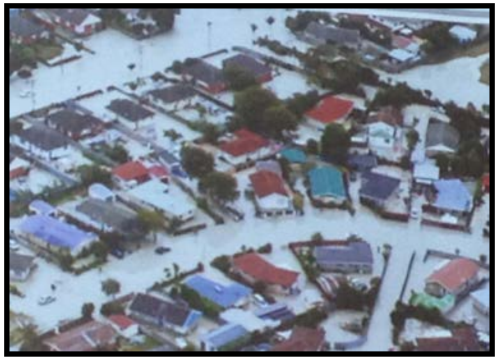


Photo by Mark Woods

Initial EQ Impacts

- 185 deceased
- ***EXTENSIVE and WIDESPREAD*** liquefaction damage
- Loss of utility power, water, and wastewater treatment utilities for weeks to years
- Significant damage to transportation network
- 600+ buildings in downtown Christchurch affected
- 43,000 seat AMI Stadium experienced pervasive damage
- ***SEVERE*** damage to unreinforced brick buildings



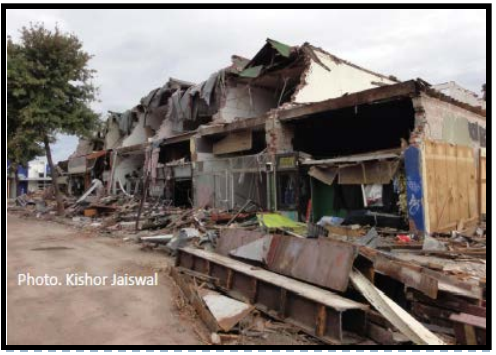


Photo. Kishor Jaiswal

Electricity Impacts

ATTENTION

Power Has Been Removed

ICP Number

Address BNZ – LONDON ST

Name

Signature

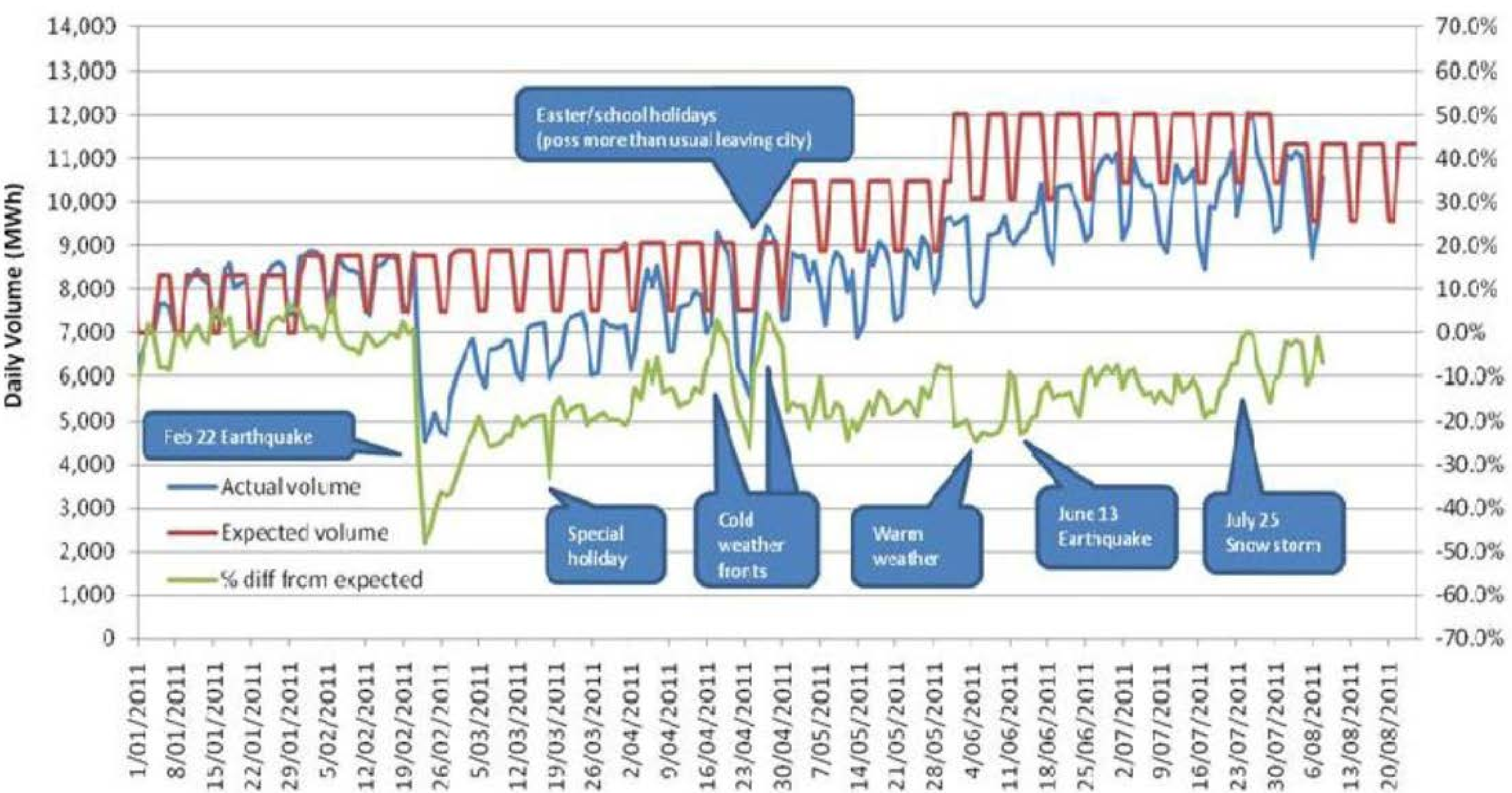
Date

Time

Orion

☎ 0800 363 9898

Orion Network Total Volumes



Easter/school holidays (poss more than usual leaving city)

Feb 22 Earthquake

Special holiday

Cold weather fronts

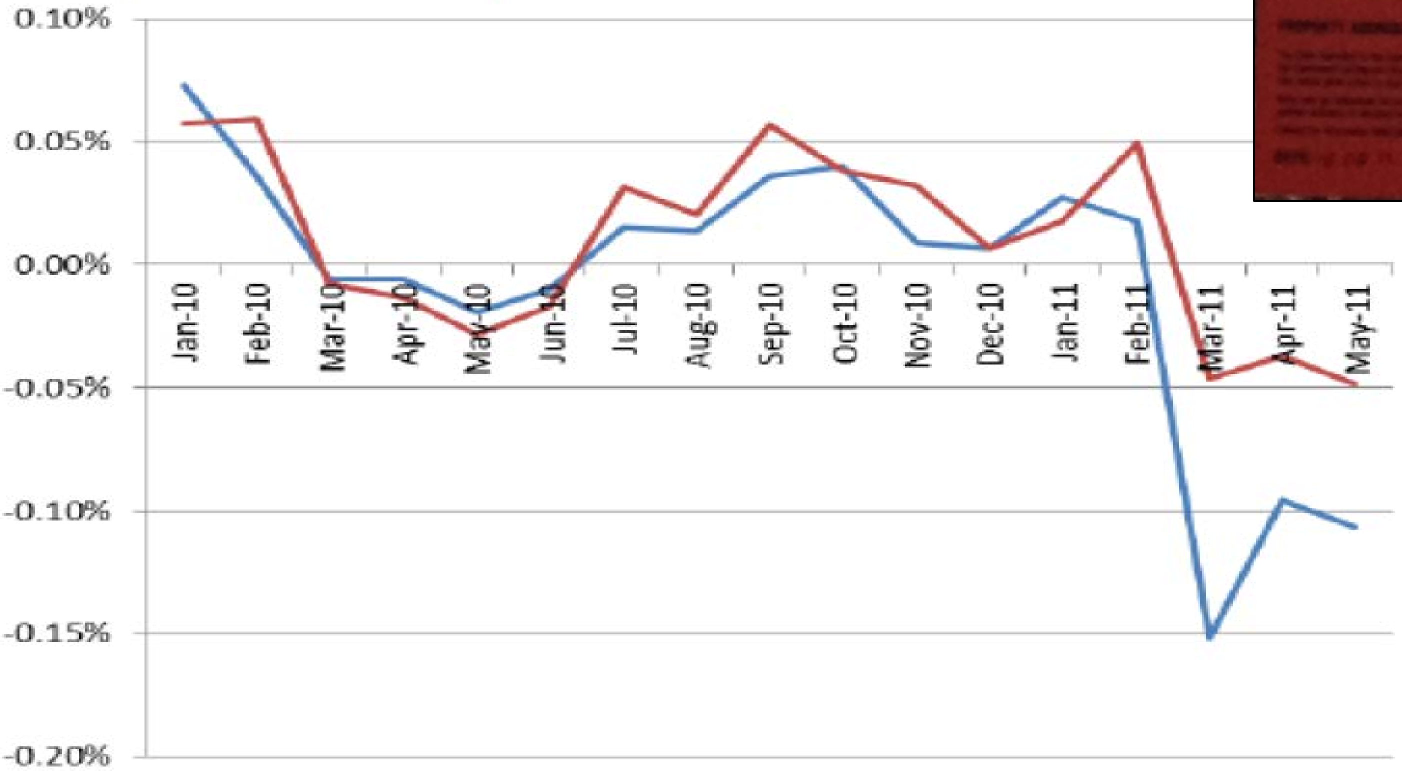
Warm weather

June 13 Earthquake

July 25 Snow storm

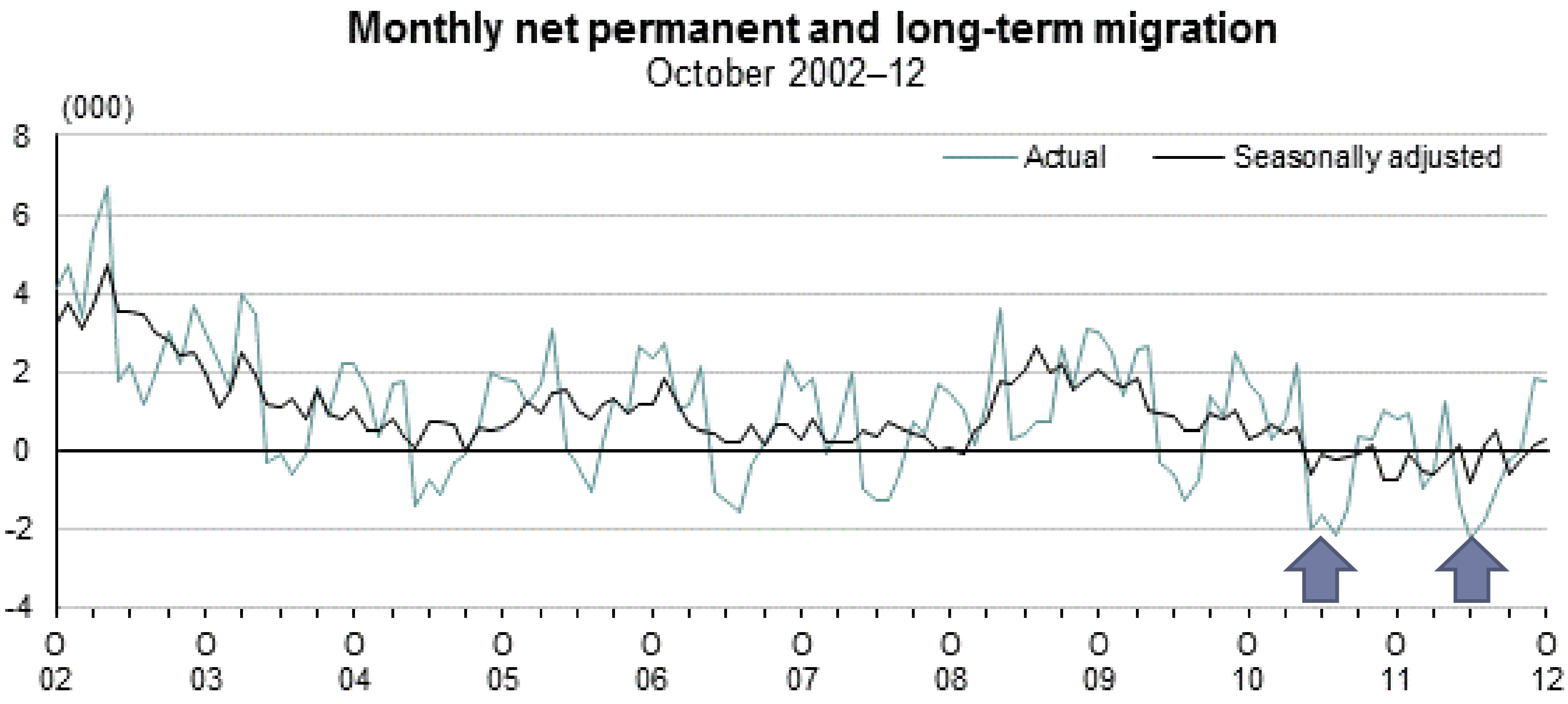
Short-Term Population Impacts

Net Migration as % of Population



Source: Statistics New Zealand

Longer-Term Population Impacts

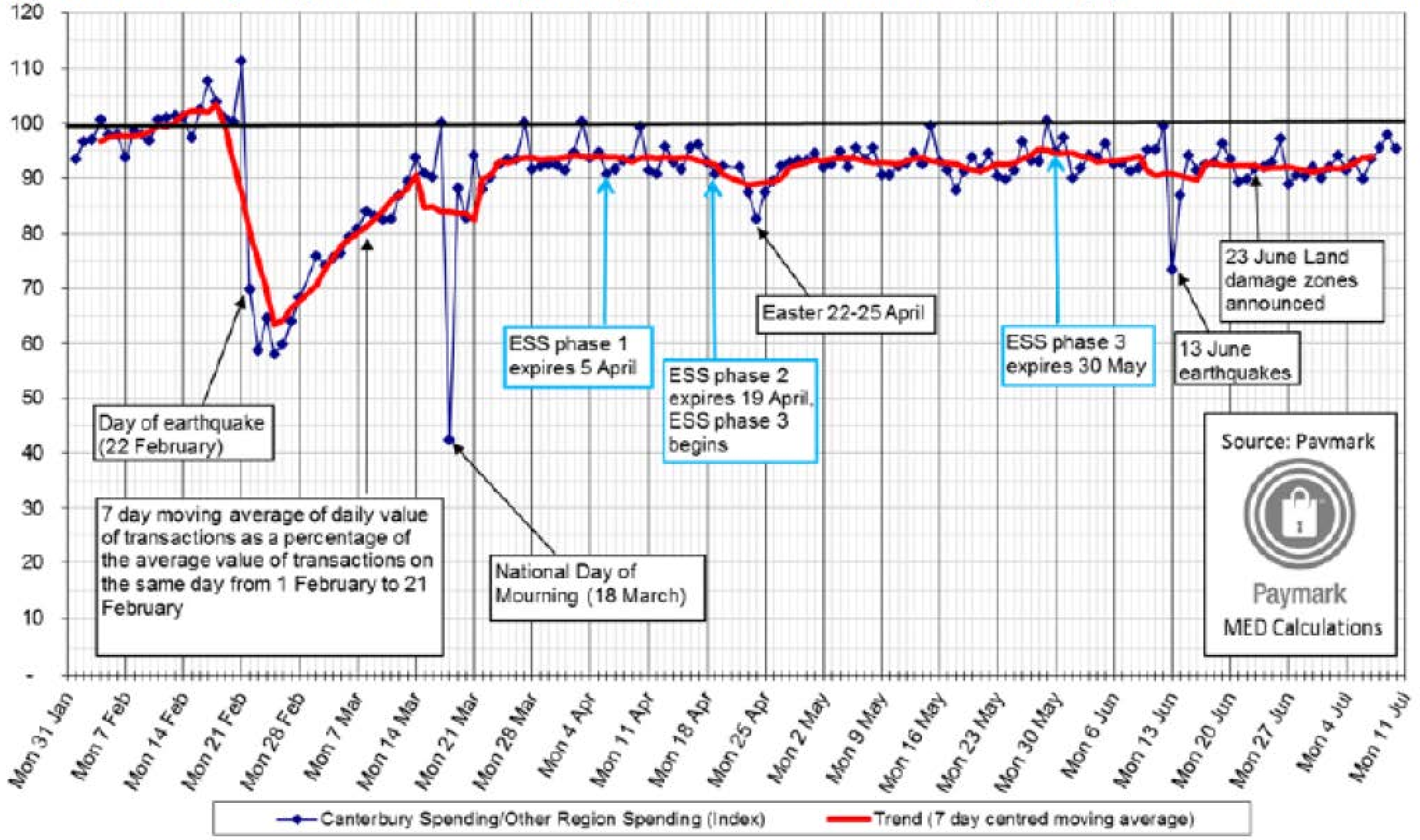


Source: Statistics New Zealand

- Note that while the population has been in flux over the longer term and is beginning to reach pre-earthquake levels, the two largest declines follow the most significant earthquakes.

Business Activity Impacts

Index of Canterbury Region EFTPOS Spending Relative to Rest of NZ Spending (1st 3 weeks of Feb=100)



Day of earthquake (22 February)

7 day moving average of daily value of transactions as a percentage of the average value of transactions on the same day from 1 February to 21 February

National Day of Mourning (18 March)

ESS phase 1 expires 5 April

ESS phase 2 expires 19 April, ESS phase 3 begins

Easter 22-25 April

ESS phase 3 expires 30 May

13 June earthquakes

23 June Land damage zones announced

Source: Paymark

MED Calculations

Liquefaction is much, much more than a nuisance…it's a game changer for recovery

- Earthquake happens…which leads to
- Liquefaction occurring…which leads to
- Sewer lines shift, break, fill with silt…which leads to
- Wastewater treatment not possible…which leads to
- Some beaches closed for 1+ years due to presence of fecal coliform bacteria…which leads to
- Impacts to health, safety, welfare, environment, tourism, recreation, etc.
- Which leads to…which leads to…which leads to…

The Canterbury Earthquakes: September 4, 2010 - ?

More than 12,000 aftershocks since September 2010 – heard time & again that Christchurch population is suffering from 'quake brain' – stress from exposure to continuous shaking…

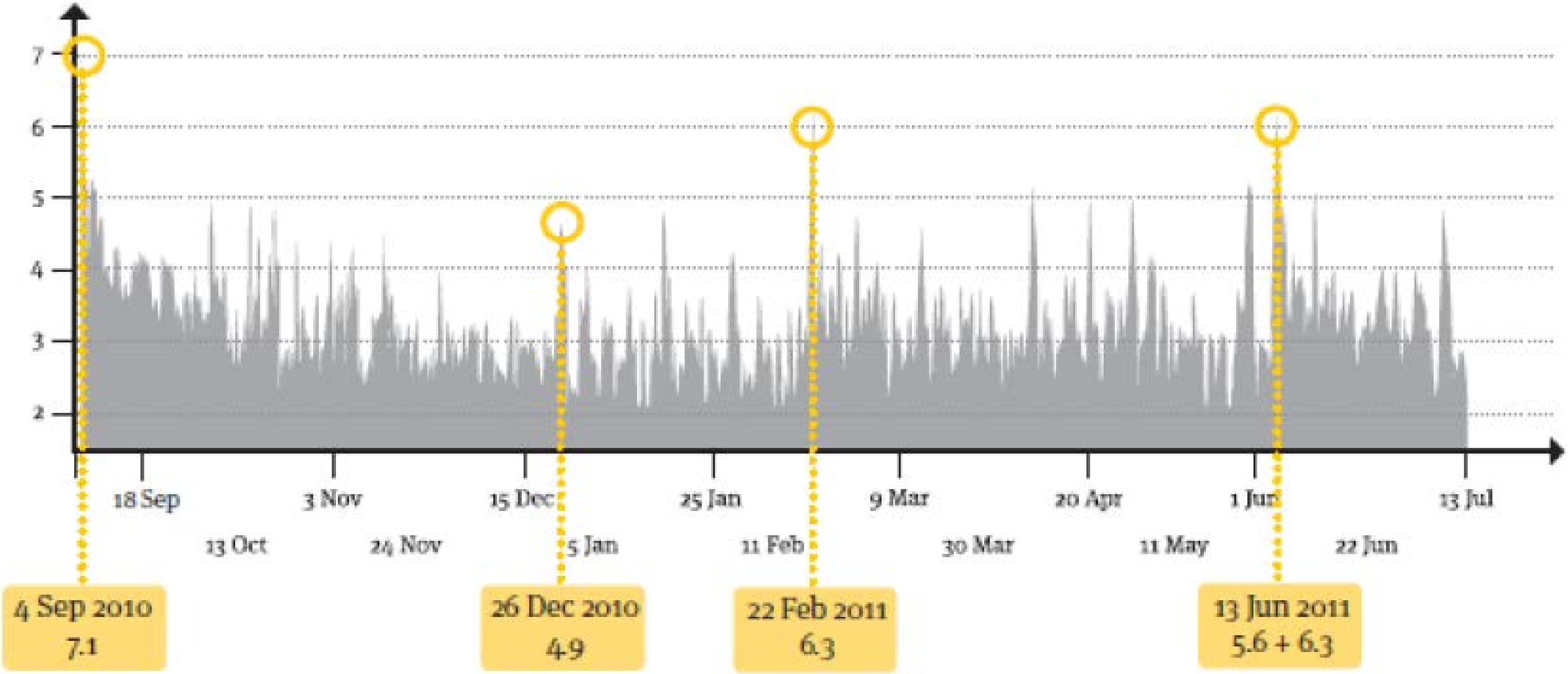
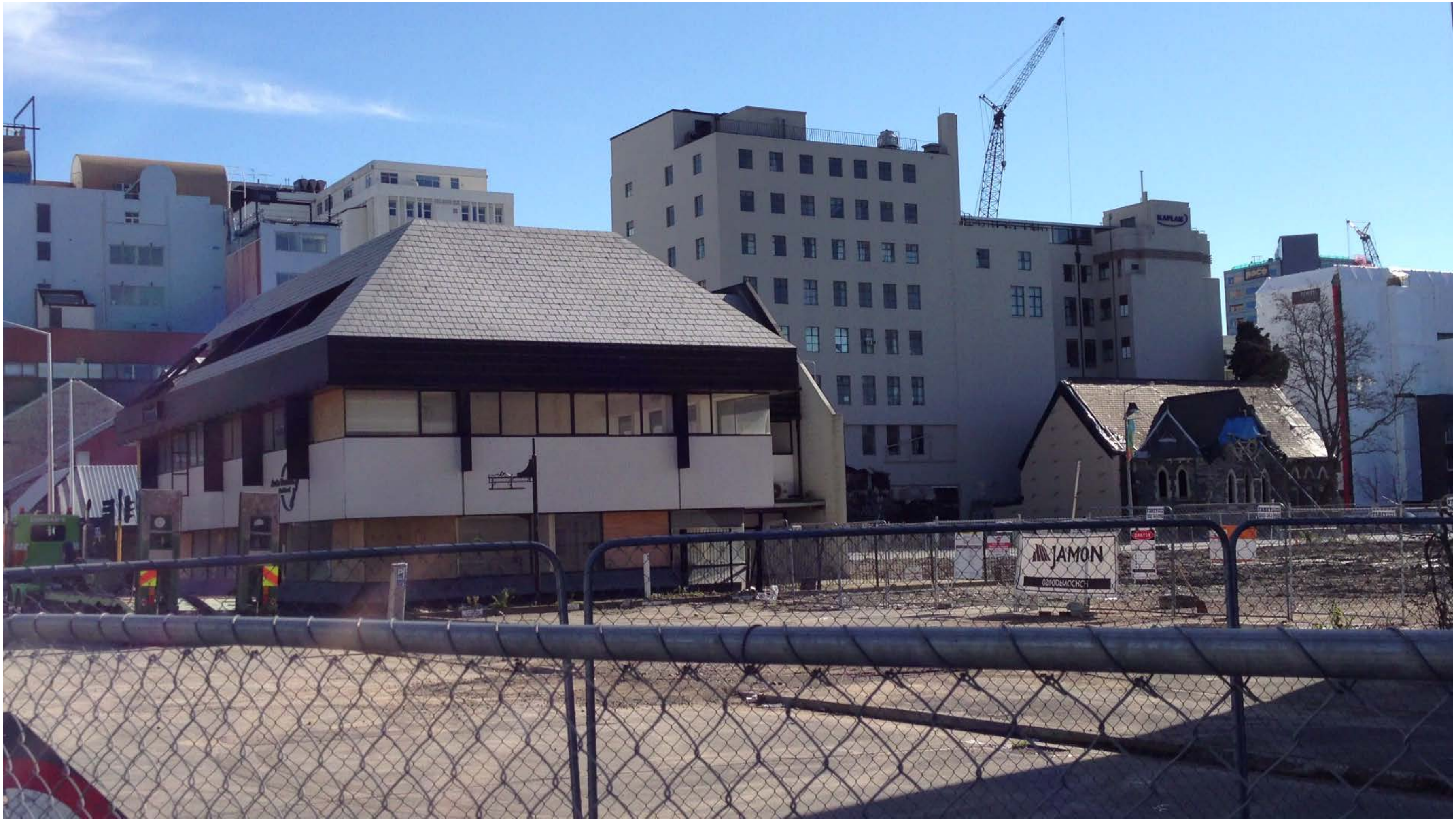


Figure from Draft Christchurch City Council Central City Plan, August 2011

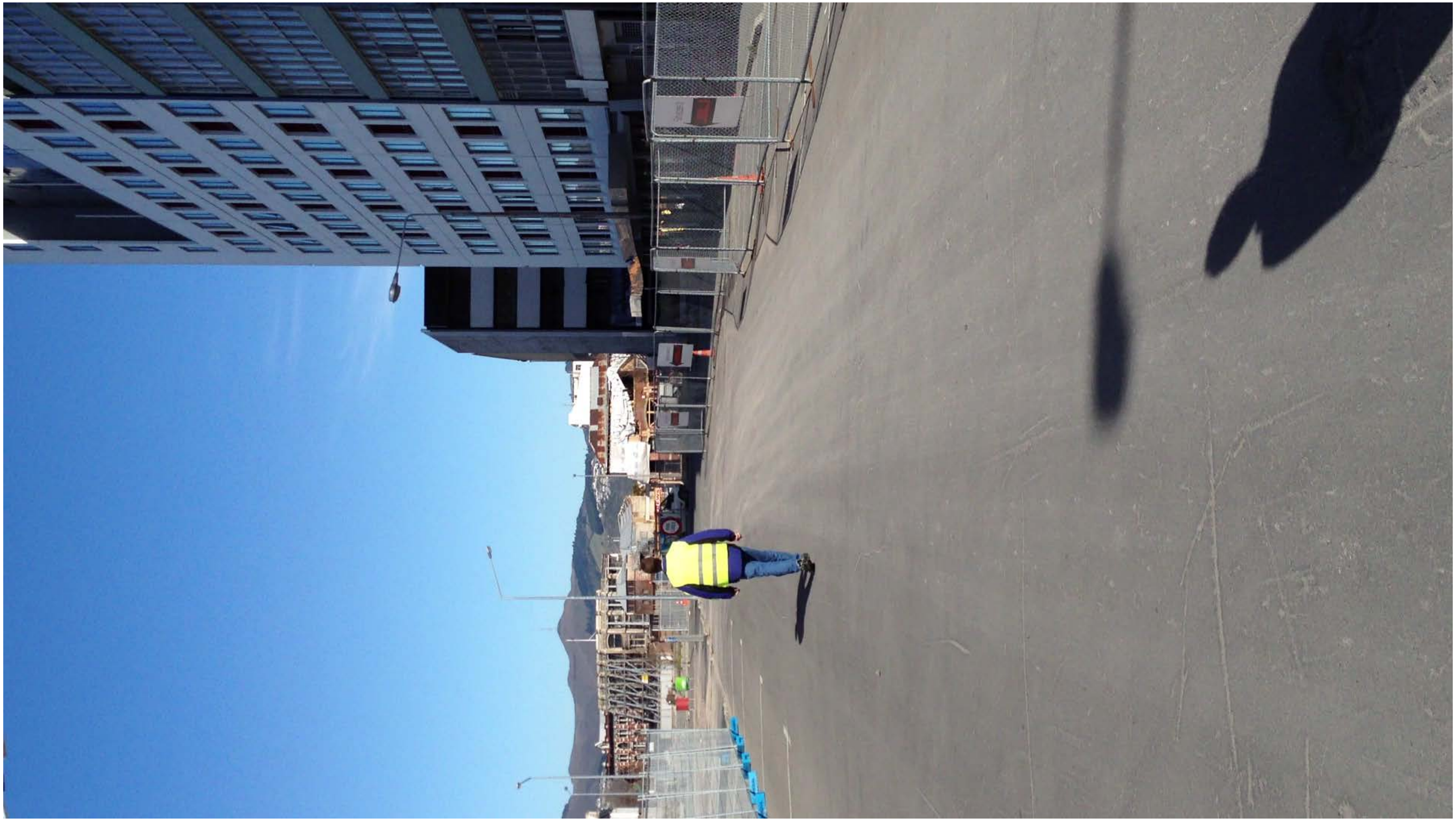
Recovery in Action

"It takes a 'munting' to build stronger; but What do we design for? Where do we put it?"

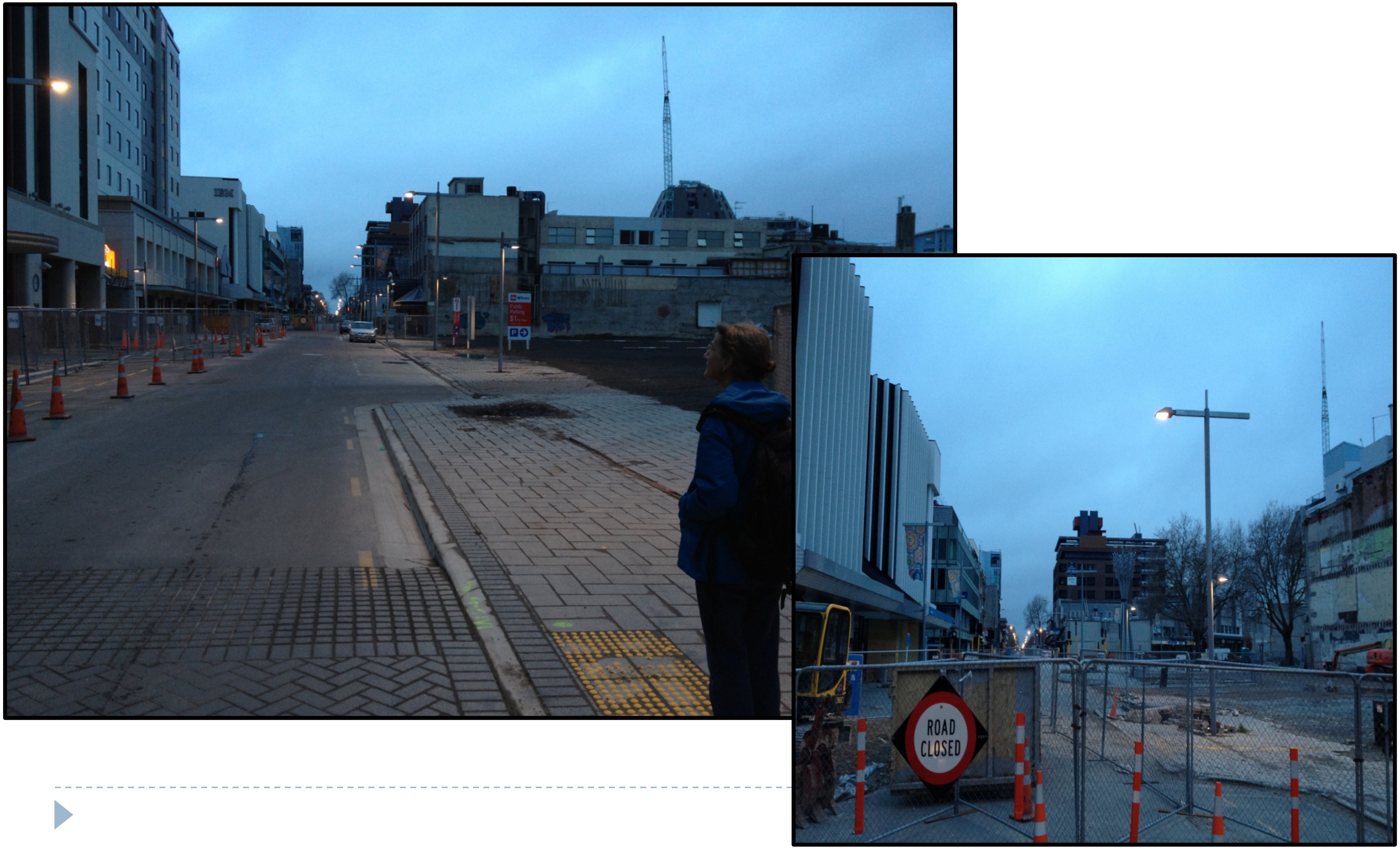
“Downtown” Christchurch 2-Years Later



“Downtown” Christchurch 2-Years Later

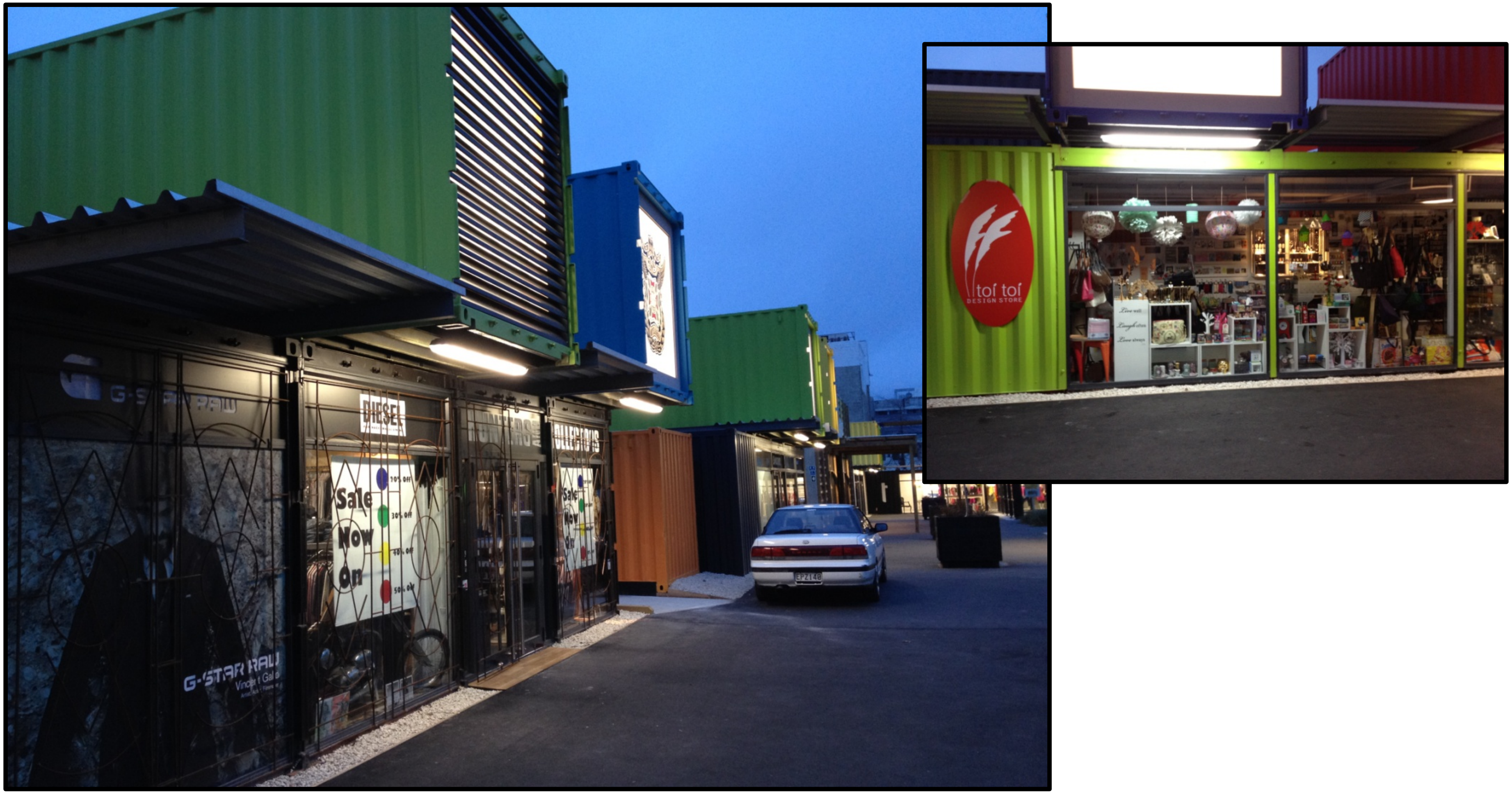


So, what do you do when your entire downtown is completely closed for 2+ years?



You think “out of the box”…

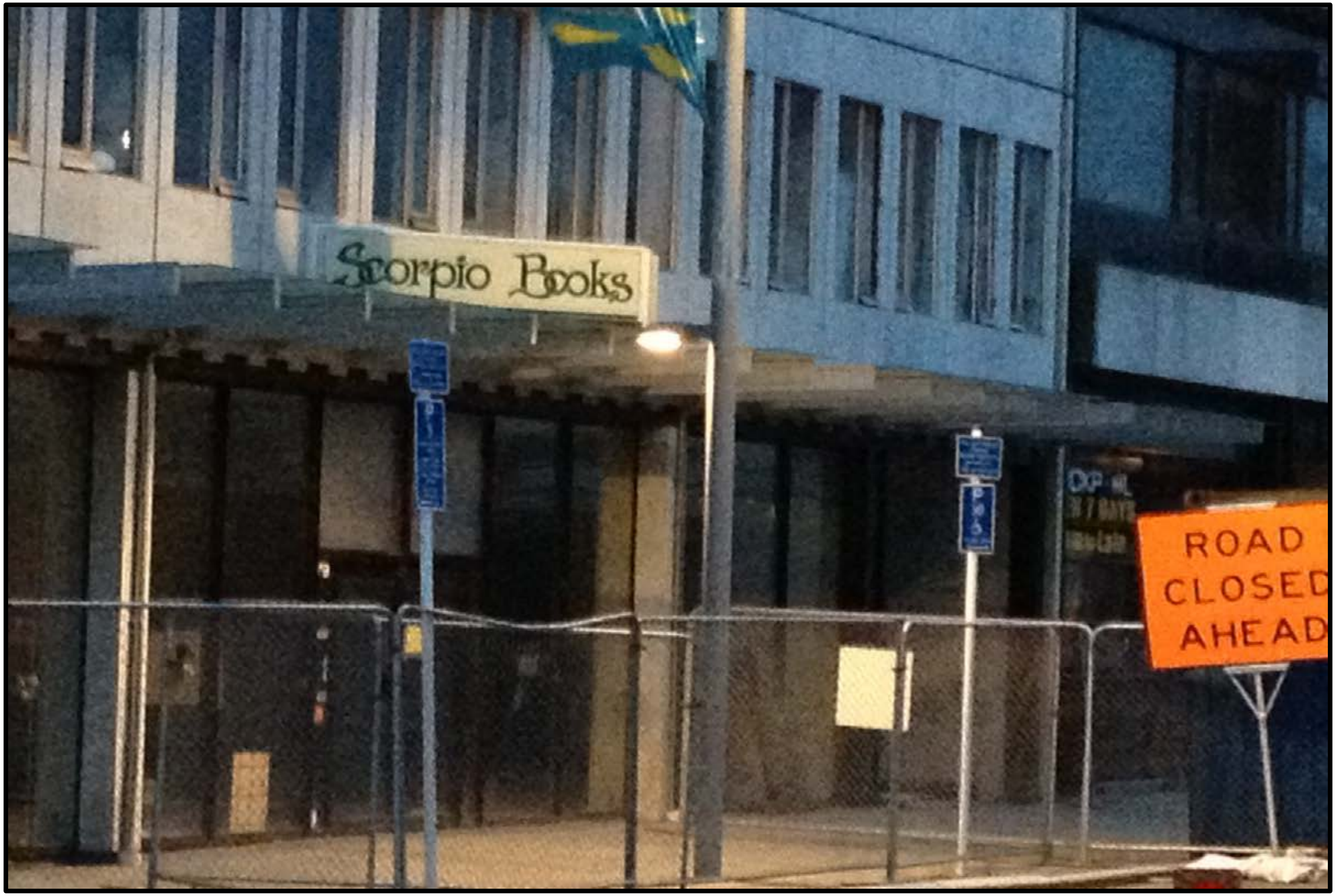
Post-Earthquake CBD Shopping Center: ReSTART Mall



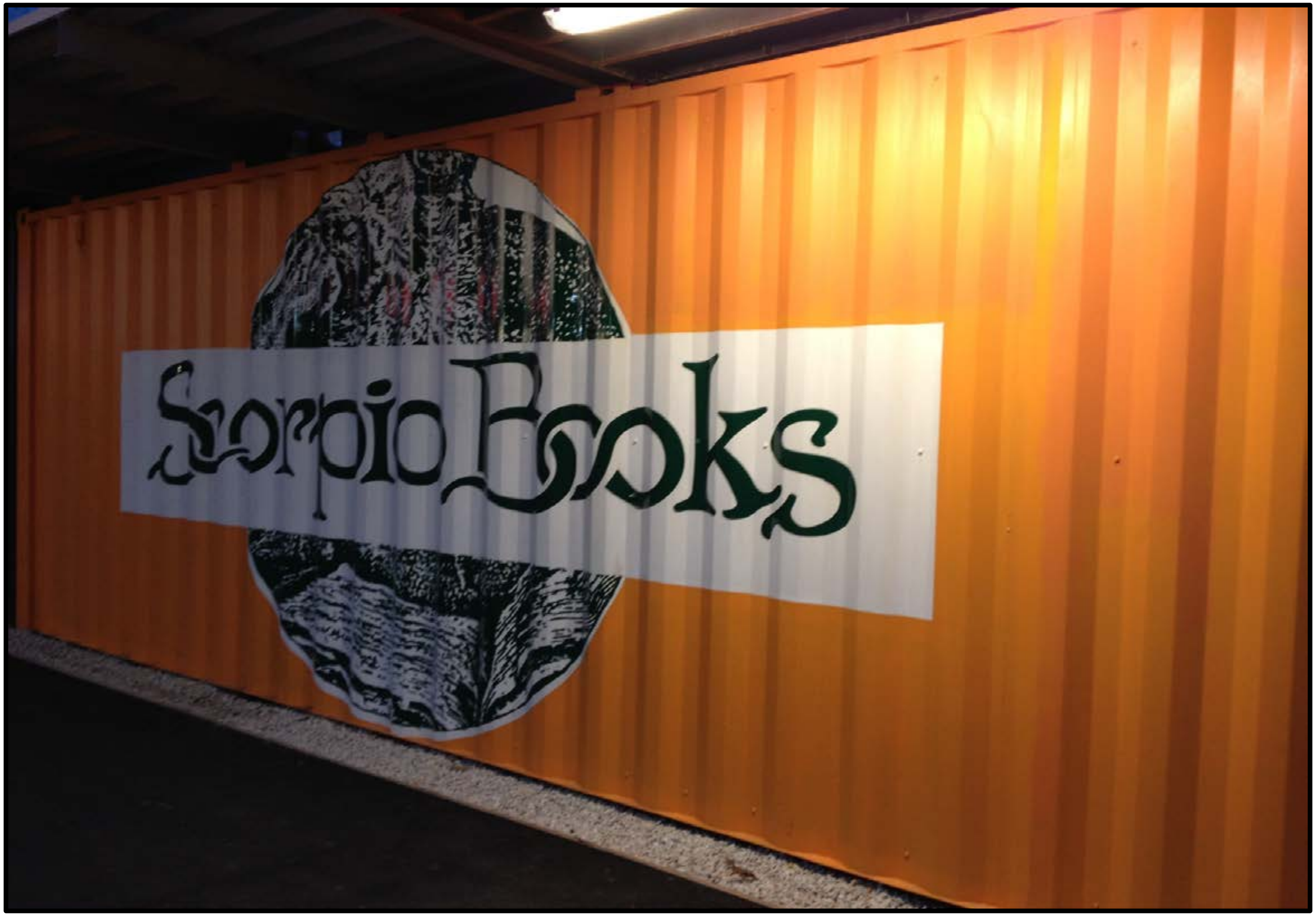
Why cargo containers?

- Temporary, non-permanent
- Standard size for easy configuration/placement
- Easy to transport
- But perhaps most importantly:
  - As temporary structures, they do not require water, sewer, or electric utilities.
  - They also do not require building permits or inspections.

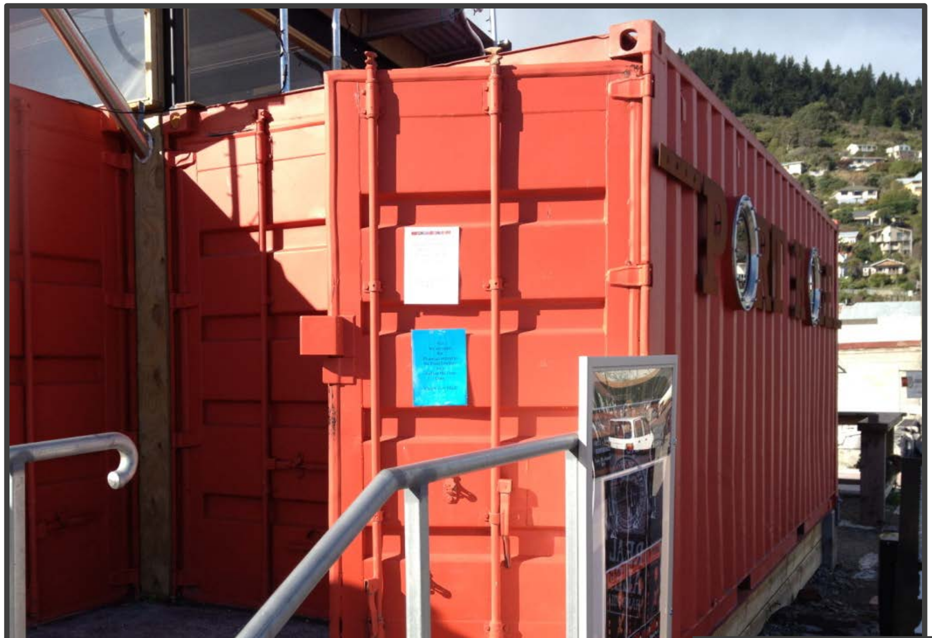
Scorpio Books…then

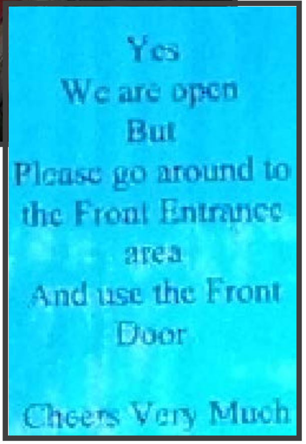


And now…



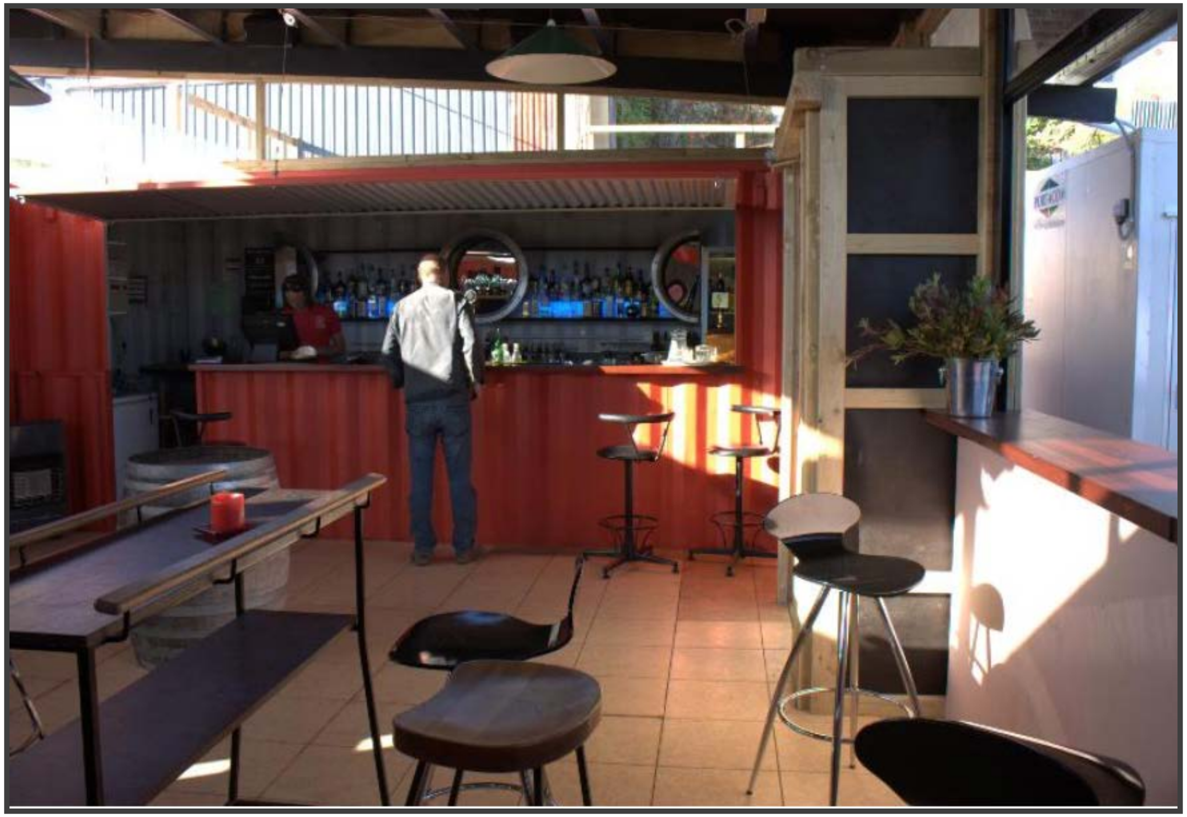
The Port Hole Bar and Grill… Lyttelton, NZ




Yes
We are open
But
Please go around to
the Front Entrance
area
And use the Front
Door

Cheers Very Much

The Port Hole Bar & Grill…Lyttelton, NZ



Making the most of (temporary?) new accommodations, the Port Hole has helped Lyttelton residents and visitors establish a new gathering place.

Post-EQ Nightlife in Christchurch: The Smash Palace

"Goodbye Blue Monday was a bar in Christchurch that ran from 2009-2011. A family owned and run business, Goodbye Blue Monday liked to think it provided some of the best gigs in Christchurch.

The bar was closed following the Christchurch earthquake on February 22nd 2011. While this was a sad time for us all, we counted ourselves lucky to be alive.

Nowadays we remember the fun times. We had so many cool bands through over the years that it felt like we were participating in helping Christchurch's up-and-comers have a stage to perform on… As well as music we had lectures, debates, life drawing classes, motorbike restoration nights, chess competitions, table tennis tournaments…

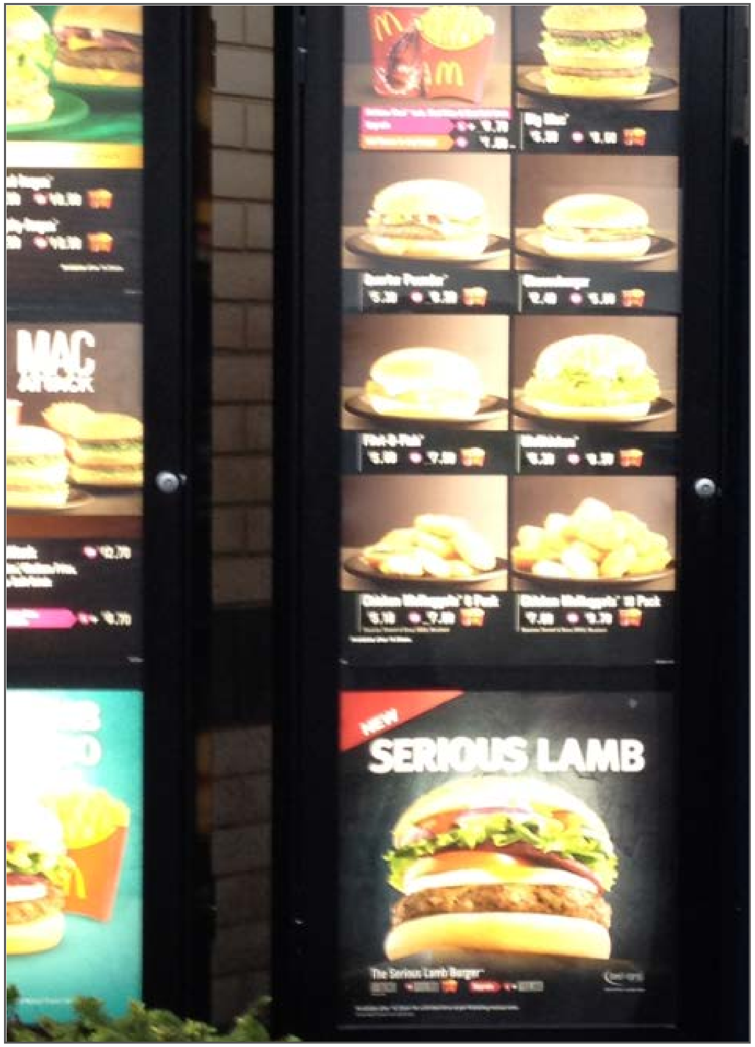
Oh, we had some fun. Now the bar is gone and all we are left with is memories."

www.thesmashpalace.com

Post-EQ Nightlife in Christchurch: The Smash Palace

Temporary retail was fairly common…

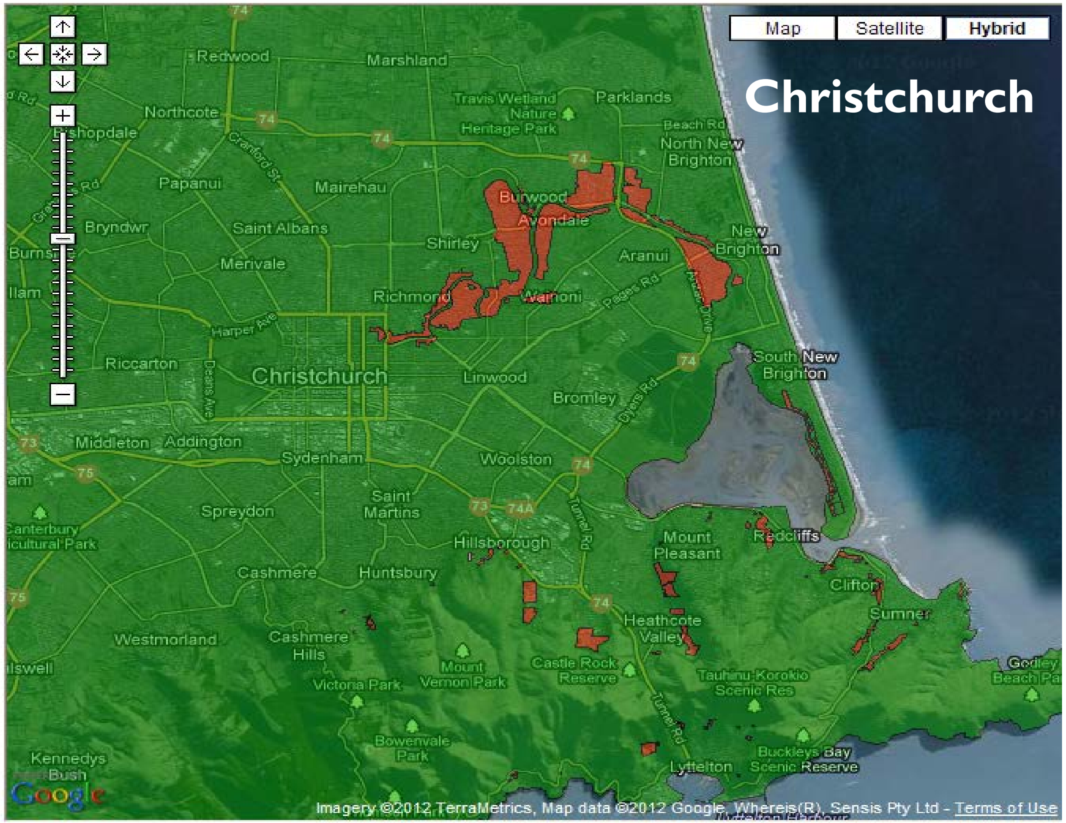
But many, many brick and mortar locations were fully operational…and some served lamb.

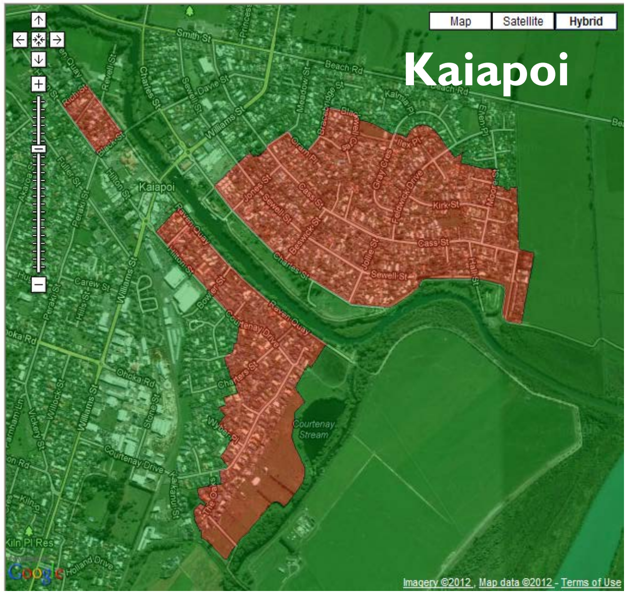


Transportation Recovery was On-Going

- Temporary solutions used in prime liquefaction zones
- Many complaints from residents about not knowing from one week to the next which roads would be open and which would be closed for to allow road and/or utility repairs.

Canterbury Earthquake Recovery Authority Land Decisions (as of Sept. 14, 2012)





Most severe liquefaction occurred near existing and historic waterways, like the Avon River in Christchurch or the Kaiapoi and Waimakariri Rivers in Kaiapoi---think Downtown and Duwamish in Seattle…

Key

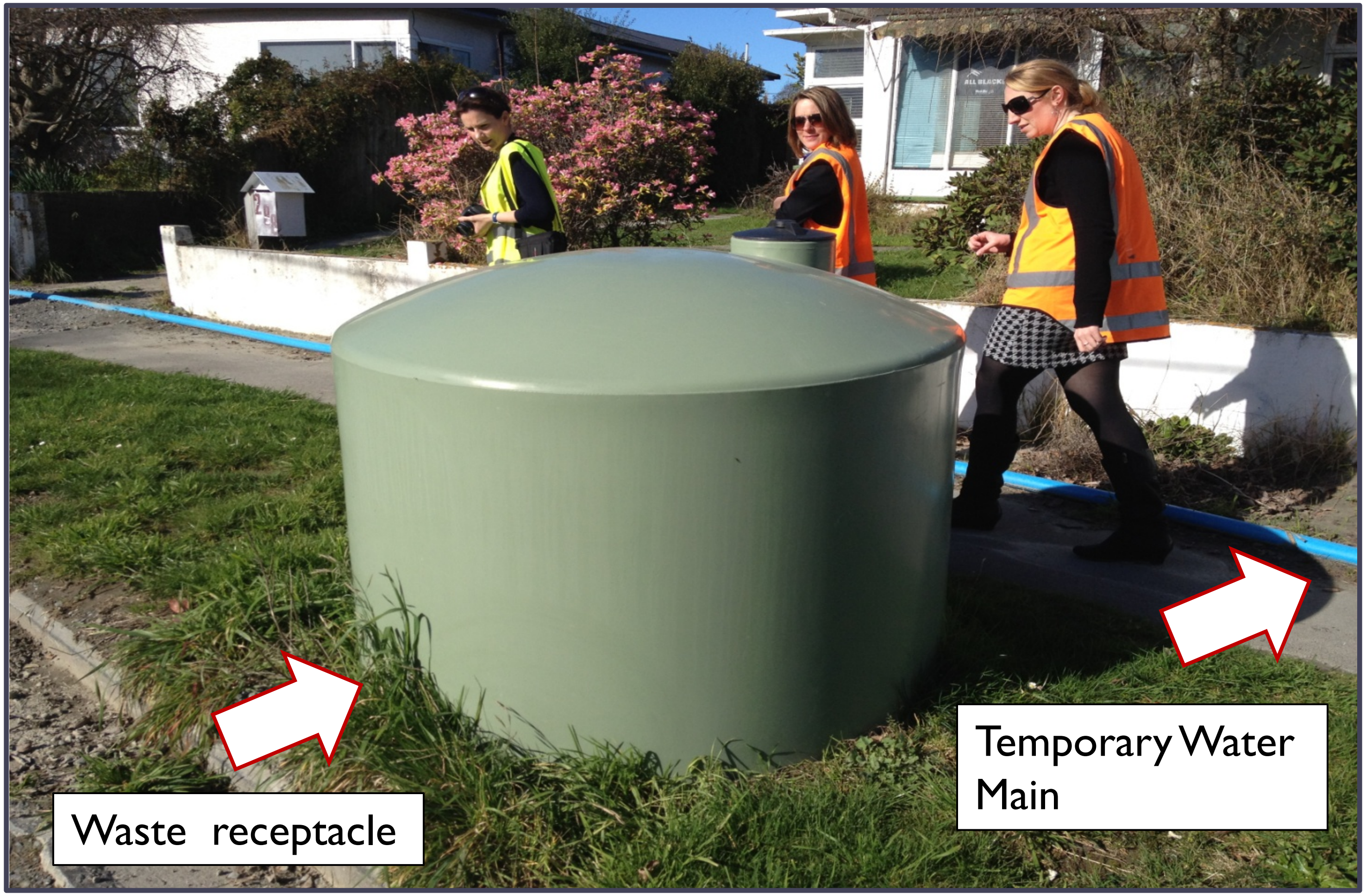
🟩 Green Zone
Repair / rebuild process can begin.

🟧 Orange Zone
Further assessment required.

🟥 Red Zone
Land repair would be prolonged and uneconomic.

☐ White Zone
CBD or hillside suburb, mapping still underway

So, how do you go to the bathroom and get water after an earthquake in a Red Zoned area?



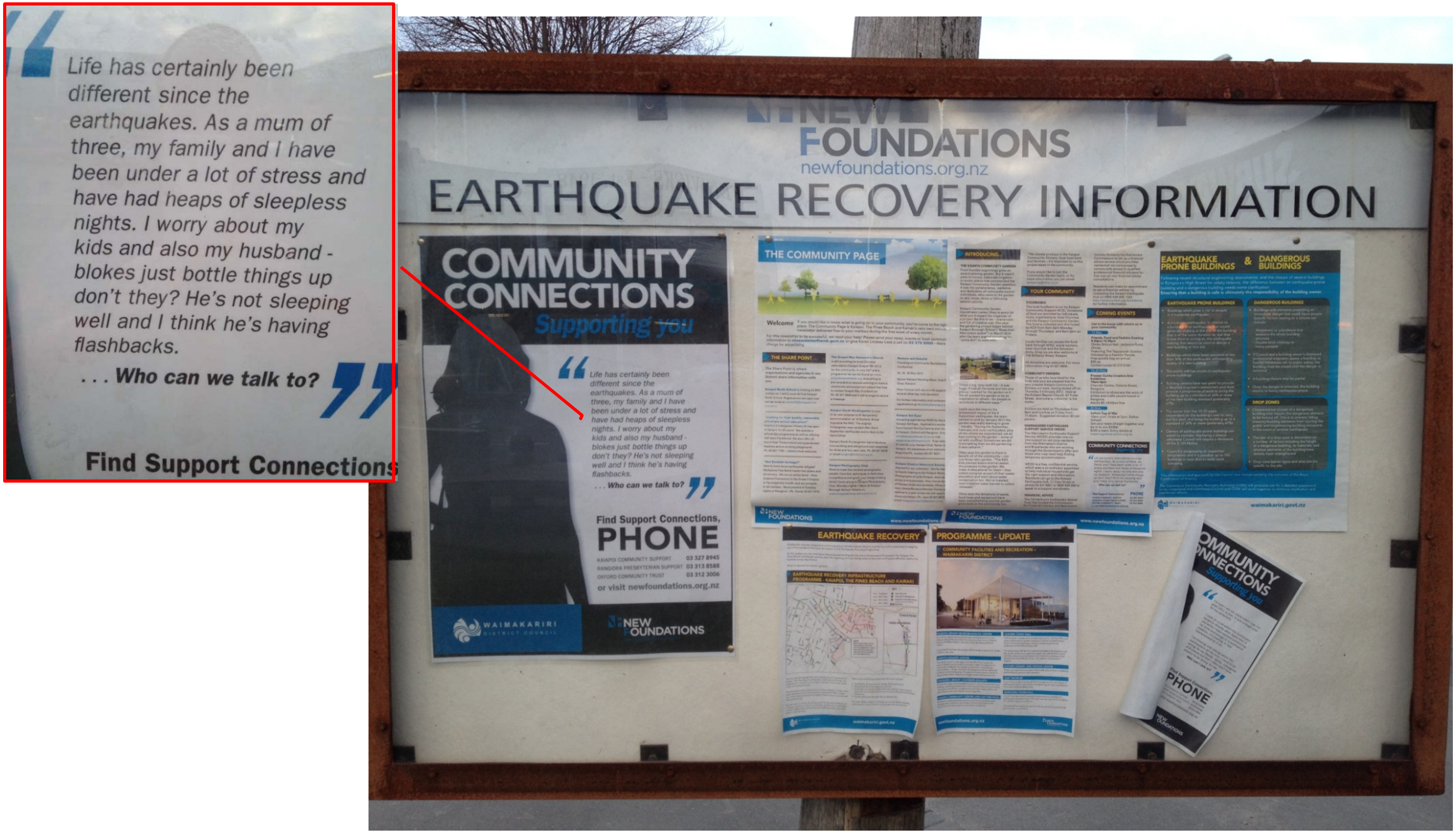
Waste receptacle

Temporary Water Main

Waimakariri District & Kaiapoi

Historic Kaiapoi

An Example of Community Notification Methods: Recovery Bulletin Boards



"Life has certainly been different since the earthquakes. As a mum of three, my family and I have been under a lot of stress and have had heaps of sleepless nights. I worry about my kids and also my husband - blokes just bottle things up don't they? He's not sleeping well and I think he's having flashbacks.

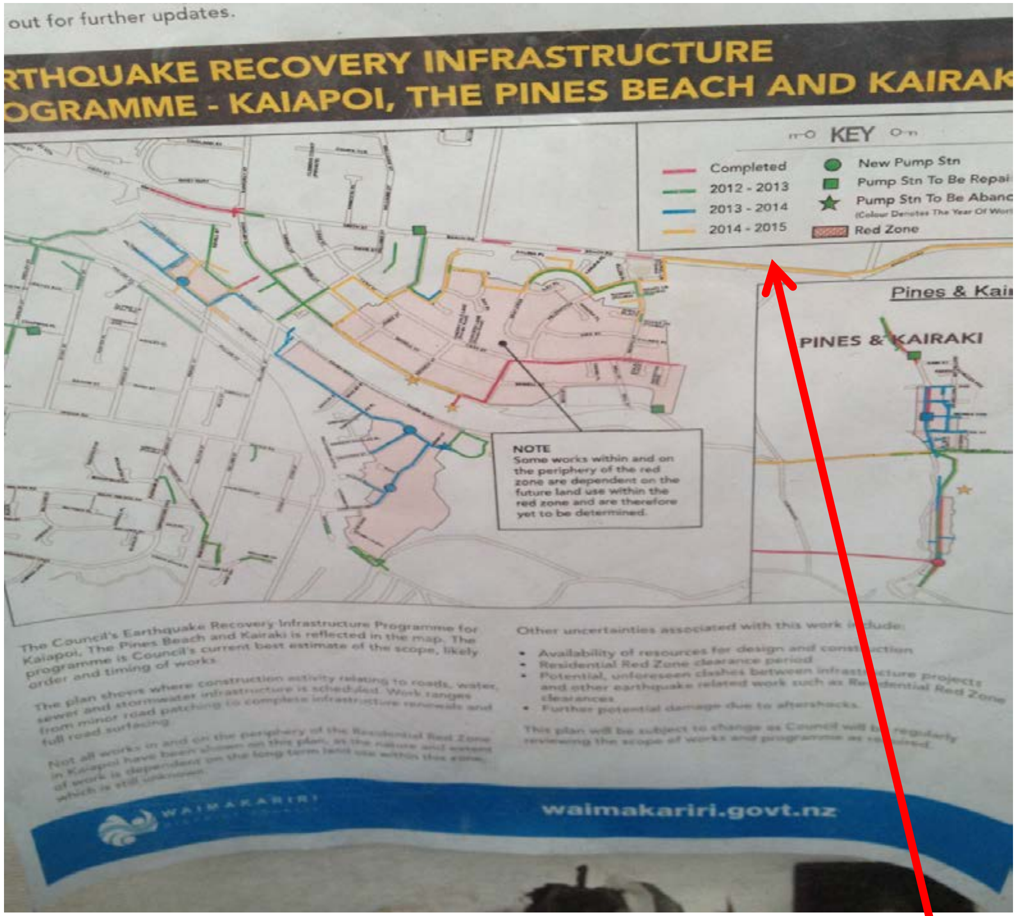
. . . Who can we talk to?"

Find Support Connections

NEW FOUNDATIONS
newfoundations.org.nz
EARTHQUAKE RECOVERY INFORMATION
COMMUNITY CONNECTIONS
Supporting you
Find Support Connections,
PHONE
or visit newfoundations.org.nz
WAIMAKARIRI DISTRICT COUNCIL
NEW FOUNDATIONS
THE COMMUNITY PAGE
EARTHQUAKE PRONE BUILDINGS & DANGEROUS BUILDINGS
EARTHQUAKE RECOVERY
PROGRAMME - UPDATE

Downtown Kaiapoi…

Specialized Teams Located in Banking/Finance Establishments


out for further updates.

RTHQUAKE RECOVERY INFRASTRUCTURE
OGRAMME - KAIAPOI, THE PINES BEACH AND KAIRAK

NOTE
Some works within and on the periphery of the red zone are dependent on the future land use within the red zone and are therefore yet to be determined.

The Council's Earthquake Recovery Infrastructure Programme for Kaiapoi, The Pines Beach and Kairaki is reflected in the map. The programme is Council's current best estimate of the scope, likely order and timing of works.

The plan shows where construction activity relating to roads, water, sewer and stormwater infrastructure is scheduled. Work ranges from minor road patching to complete infrastructure renewals and full road surfacing.

Not all works in and on the periphery of the Residential Red Zone in Kaiapoi have been shown on this plan, as the nature and extent of work is dependent on the long term land use within this zone, which is still unknown.

Other uncertainties associated with this work include:

- Availability of resources for design and construction
- Residential Red Zone clearance period
- Potential, unforeseen clashes between infrastructure projects and other earthquake related work such as Residential Red Zone clearances
- Further potential damage due to aftershocks.

This plan will be subject to change as Council will be regularly reviewing the scope of works and programme as required.

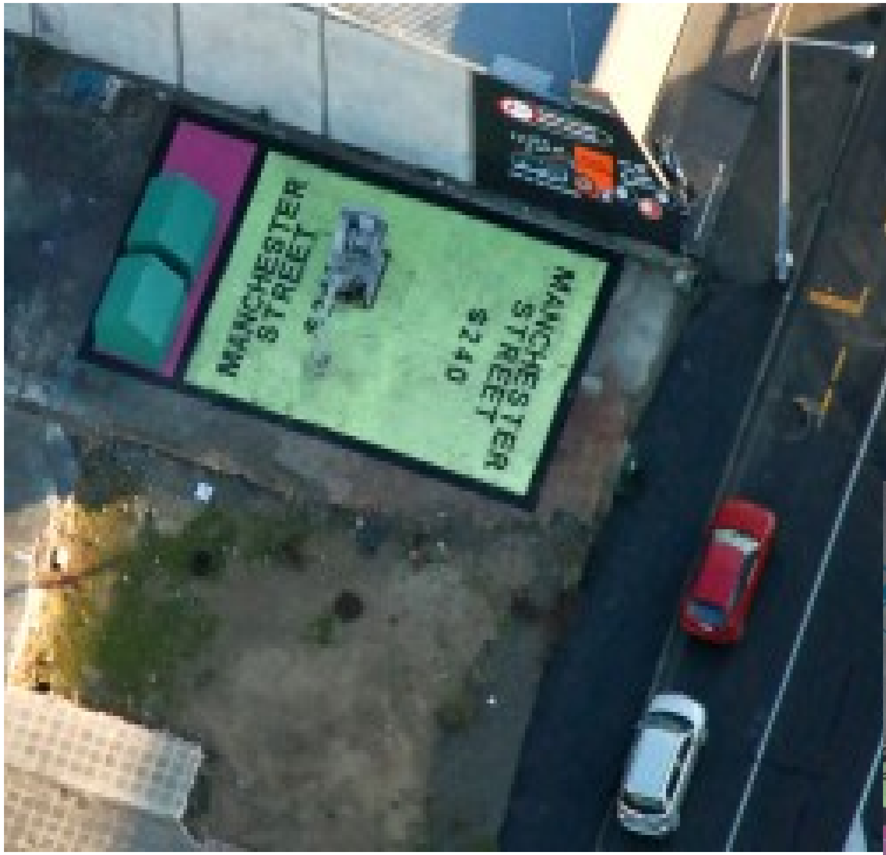
WAIMAKARIRI

waimakariri.govt.nz

Map Showing Planned/Programmed Infrastructure Repairs (Yes, that says 2015.)

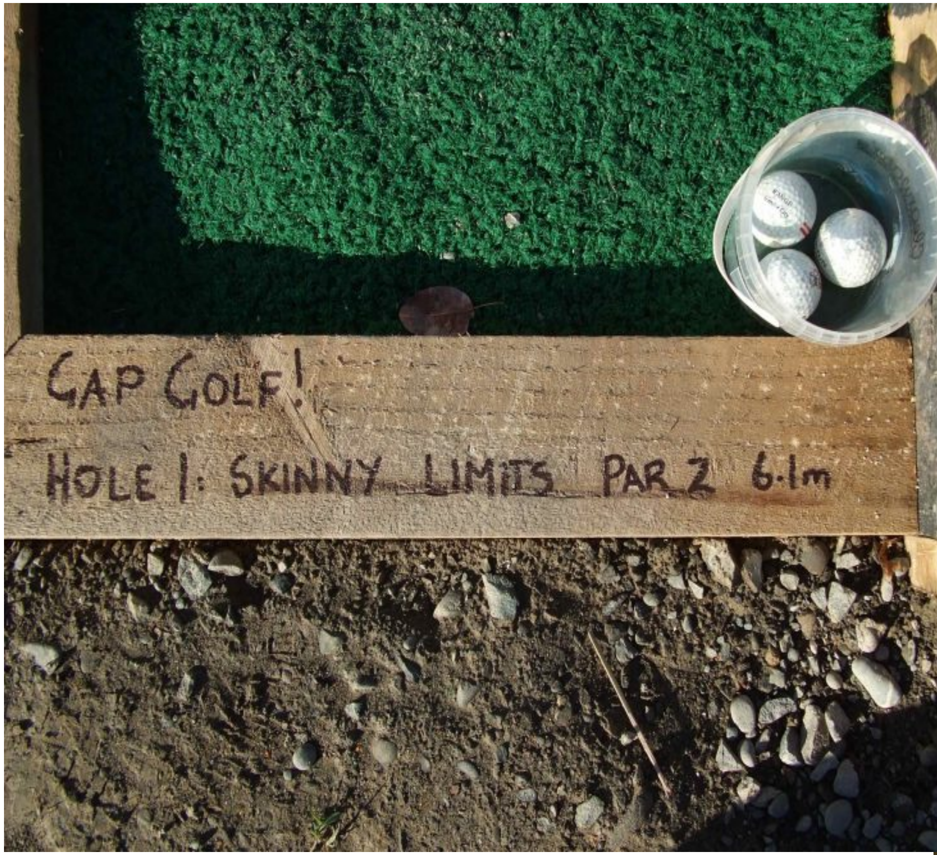
Many new opportunities for community open space & public art

Restoring a sense of place (& having fun!), even if it's just temporary… Gap Monopoly



- http://www.gapfiller.org.nz/

Restoring a sense of place (& having fun!), even if it's just temporary… Gap Golf



- http://www.gapfiller.org.nz/

Restoring a sense of place (& having fun!), even if it's just temporary… Gap Chess

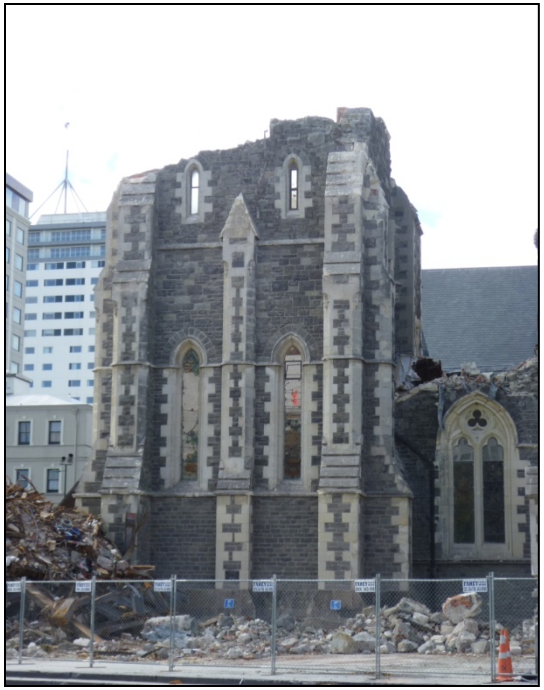
- http://www.gapfiller.org.nz/

Where and how we build in earthquake country…matters.

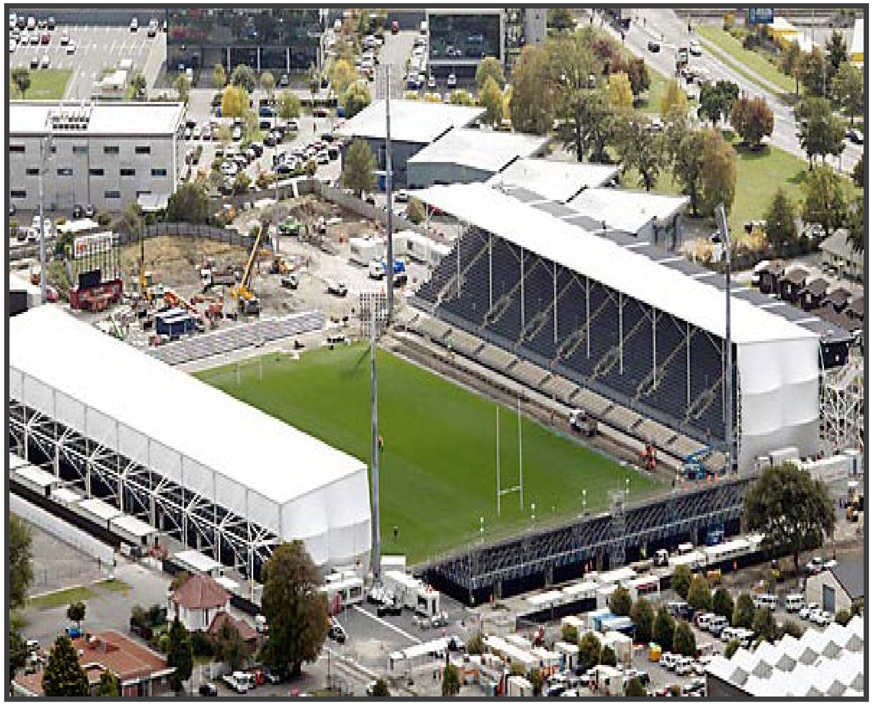
If ever there is a case to be made for pre-earthquake mitigation, this is it.

Long-term consequences to historic structures: Unreinforced Masonry Buildings

- We typically place increased value on historic structures and our places of worship. However, without appropriate mitigation in advance of an earthquake, we are left with few options afterwards and most must be demolished…



Long-term consequences of life-safety only codes: AMI Stadium



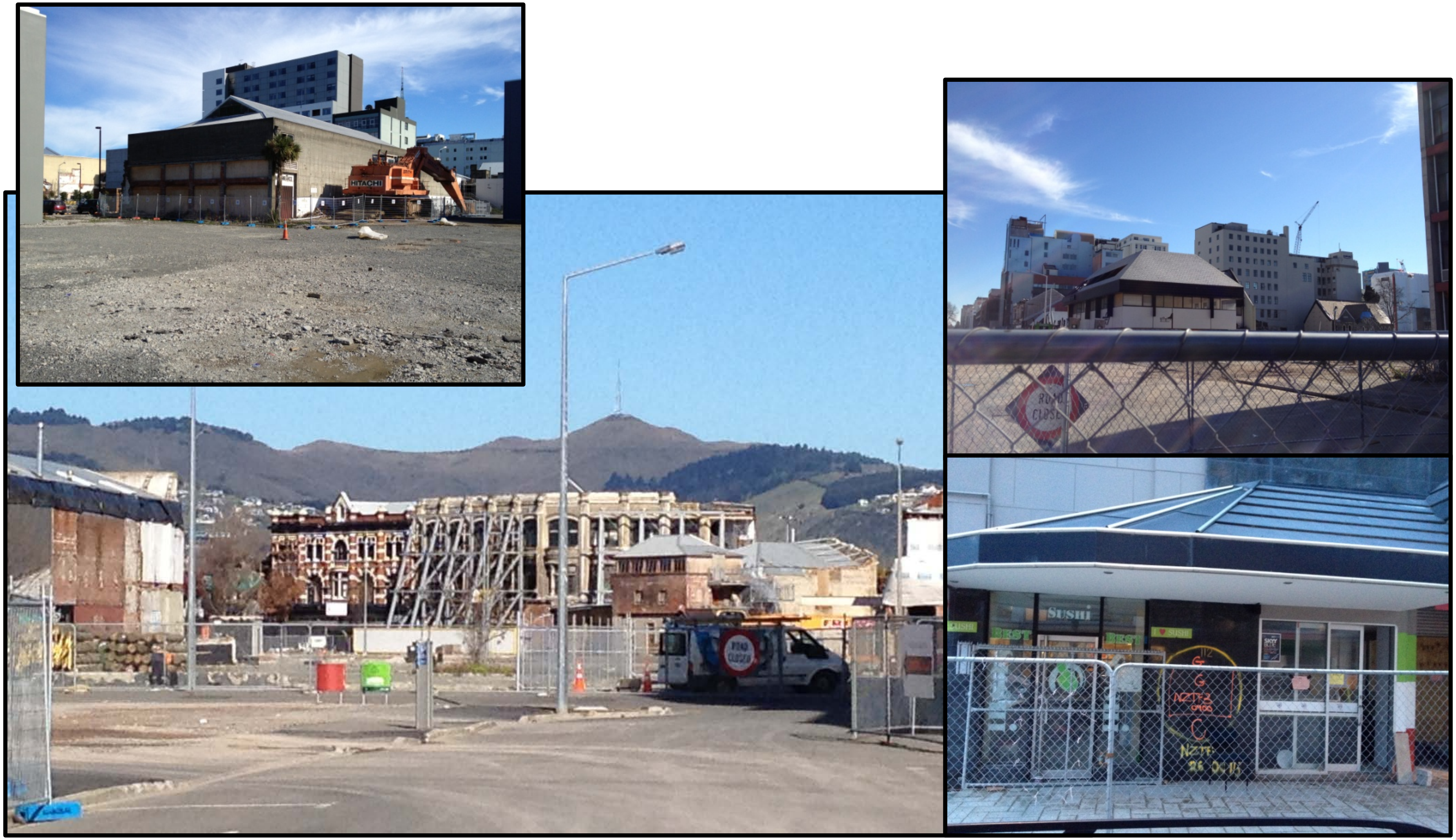
Welcome to the new AMI Stadium

The stadium suffered considerable structural damage in the 2011 quakes. Built in under 100 days, the new AMI Stadium has brought back the ability for the city to host large outdoor sporting and music events once again.

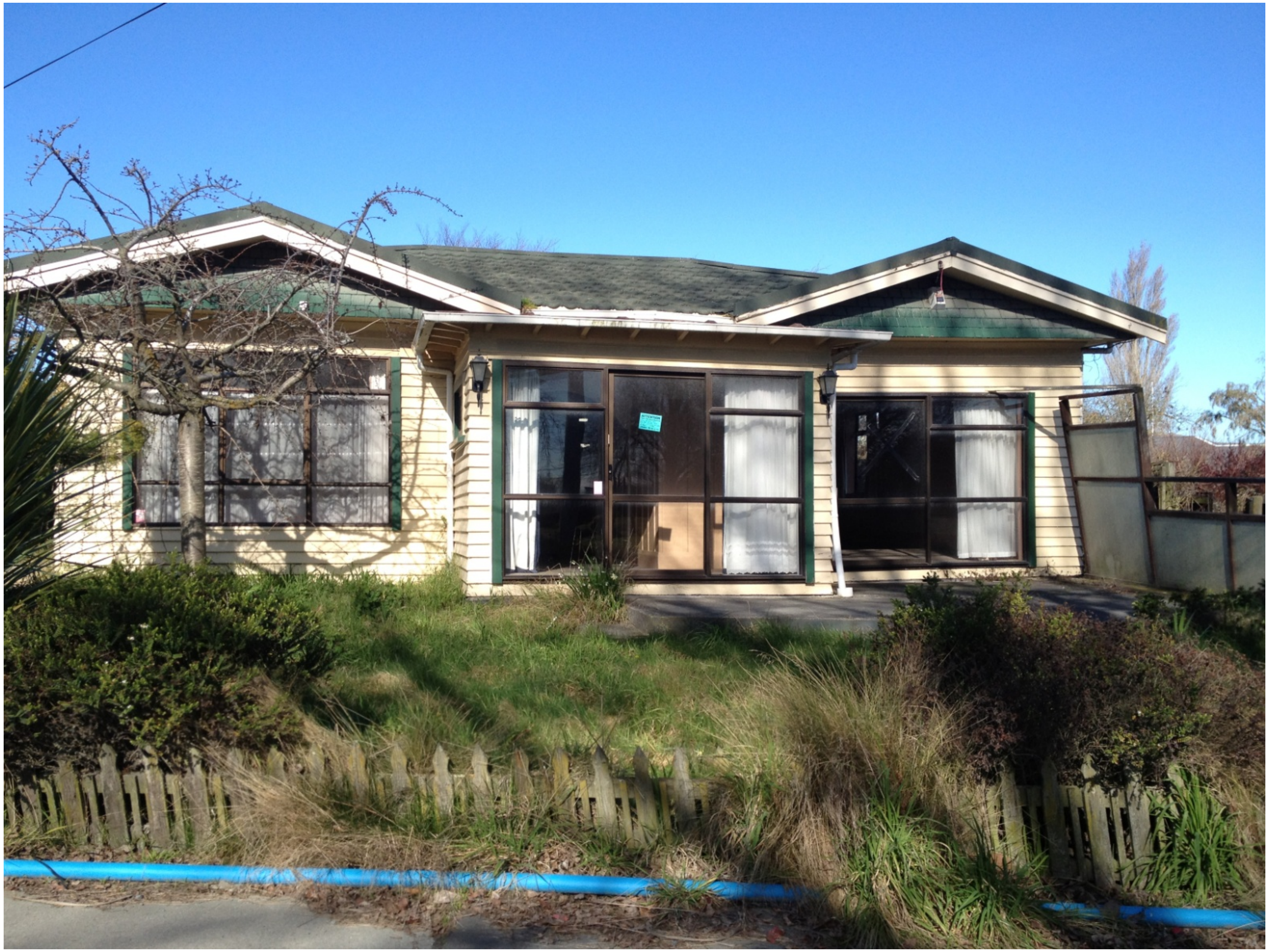
Think about the emotional and economic impacts to a community when they lose the ability for their local & national teams to play sport.

http://www.vbase.co.nz/venues/ami-stadium

Long-term consequences of life-safety only codes: Example – Downtown Businesses

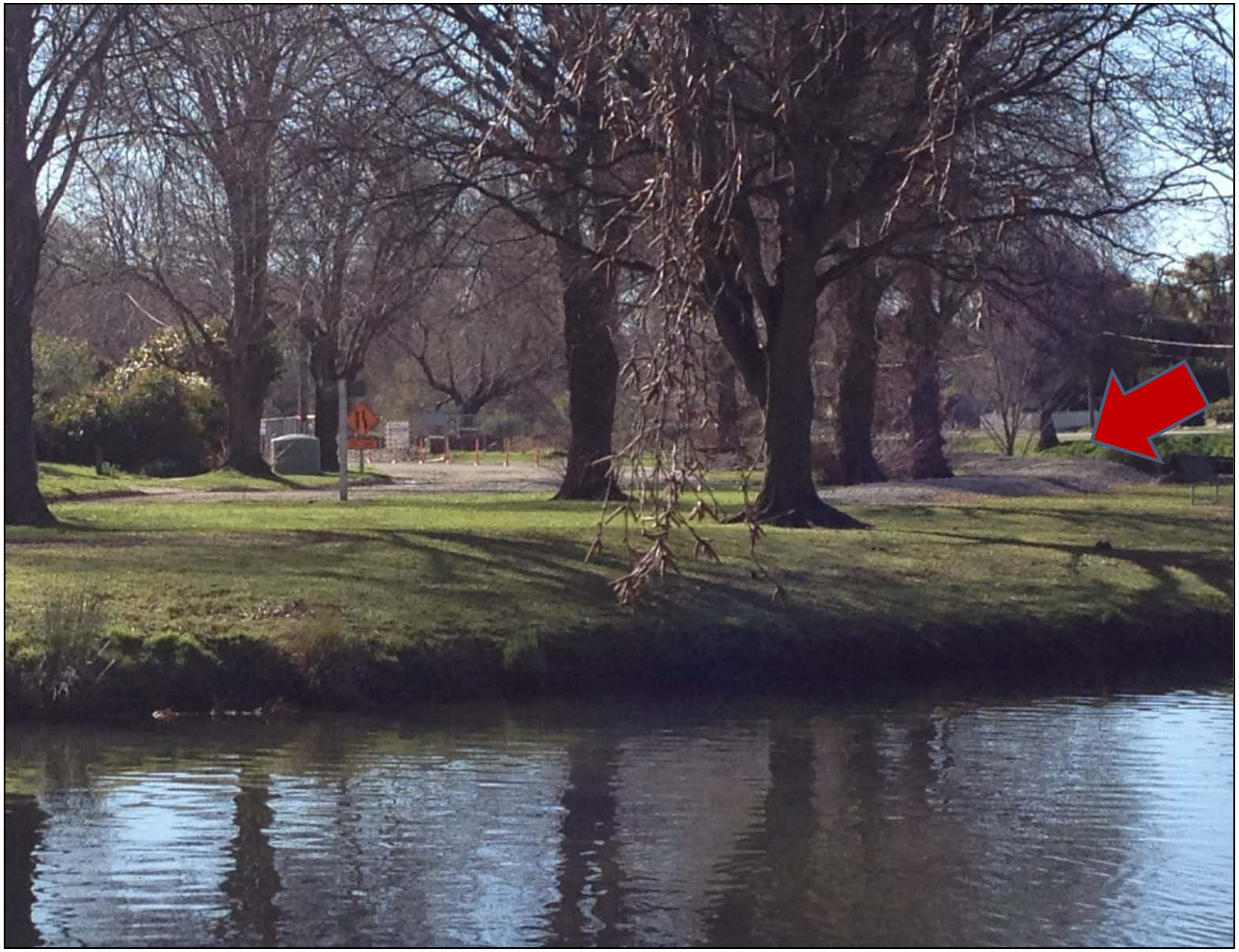


Long-term consequences of construction in liquefaction areas: Example - Neighborhoods



Long-term consequences of construction in liquefaction areas: Example - Neighborhoods

Long-term consequences of construction in liquefaction areas: Example – Flood control



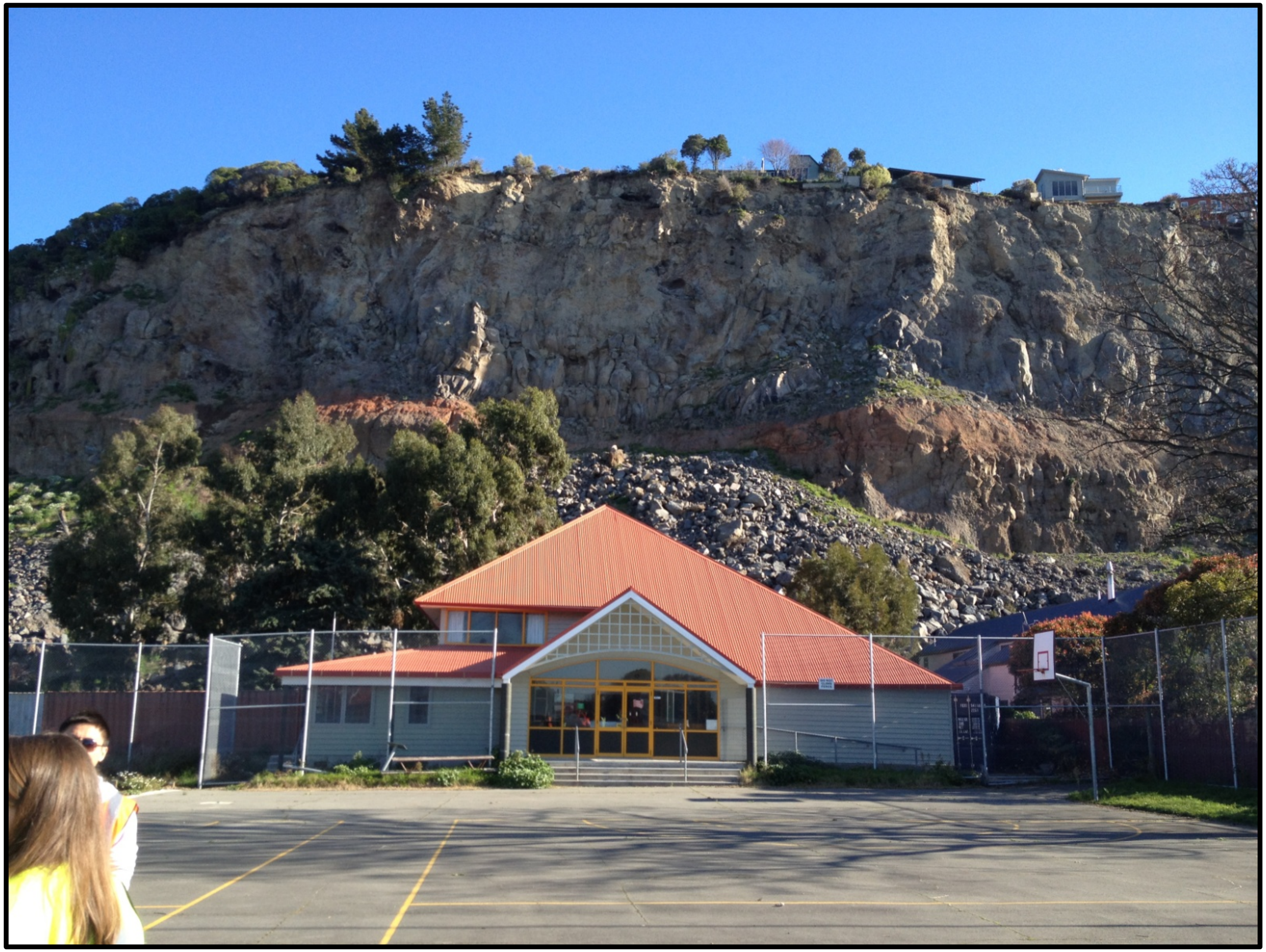
Temporary levee along the Avon River for flood control due to lateral spreading

Also note the:

- Gravel street with single travel lane
- Green refuse container in the distance.

This *is* life in a post-earthquake neighborhood that was built in a liquefaction area.

Long-term consequences of construction in landslide areas: Example - Schools

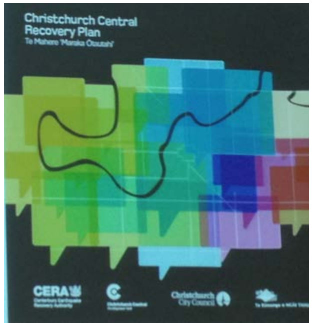


Top 10 Biggest Issues & Challenges 2 years on…

- I. Initial Establishment/Organization of a Recovery Authority
  - Canterbury Earthquake Recovery Authority established 1 month after earthquake
  - CER Act passed 2 months afterward giving CERA extensive powers
  - Responsive in establishing the an authority, but many residents are frustrated with effectiveness
- II. Central Business District remains closed 2 years later
  - Remains closed, in part, due to collapse hazards of taller buildings
- III. Earthquake Insurance – Pros & Cons
  - Lack of initial surge capability/staff by EQC Earthquake Commission to process insurance claims to expedite recovery
  - Lack of clarity on just which earthquakes were covered
  - Dealing with cumulative earthquake impacts to a structure
  - 80% of losses are covered under insurance, making this the most insured earthquake in modern history

Top 10 Biggest Issues & Challenges 2 years on…

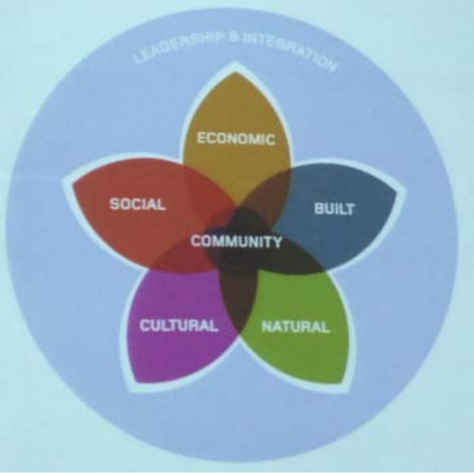
- IV. Development of a recovery plan and accommodating long-term instability from liquefaction damage
- V. Removal of entire neighborhoods and horizontal utilities damaged by liquefaction
- VI. Population Movements and Notification/Consenting on Redevelopment Plans, Buy-Outs, & Settlement
- VII. Labor supply and accommodating influx of people to work on the "Christchurch Rebuild"
- VIII. Numerous responsibilities across multiple agencies
- IX. Displacement of children again & again as well as lack of resources for those who moved outside of Christchurch
- X. Affordability and "Financing the Rebuild"



Christchurch Central Recovery Plan

CERA

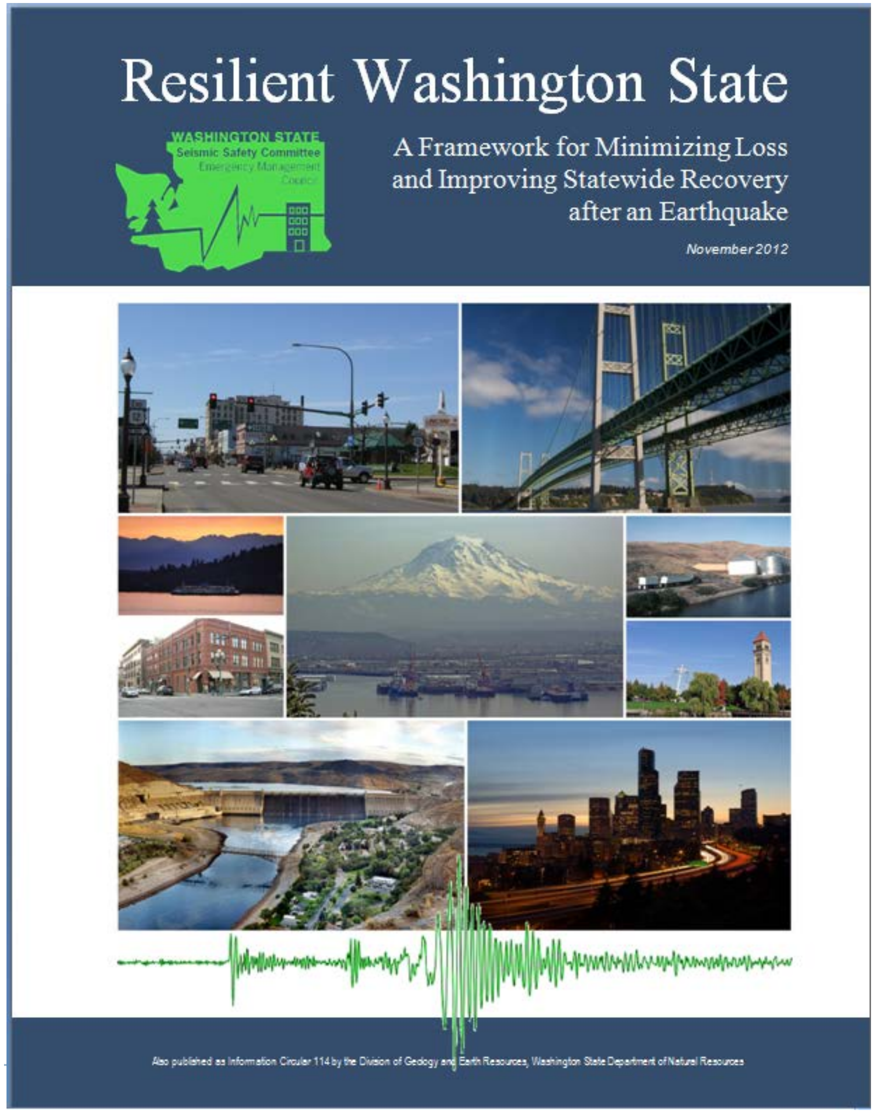
Christchurch City Council



Let’s bring this back home for a moment and ask ourselves….

How would Washington State fare with a “Christchurch” earthquake???

The Resilient Washington State Initiative



Resilient Washington State

WASHINGTON STATE
Seismic Safety Committee
Emergency Management Council

A Framework for Minimizing Loss
and Improving Statewide Recovery
after an Earthquake

November 2012

Also published as Information Circular 114 by the Division of Geology and Earth Resources, Washington State Department of Natural Resources

An Entirely New Framework & Approach for Post-Earthquake Recovery brought you by…

WASHINGTON STATE
Seismic Safety Committee
Emergency Management Council

WA Seismic Safety Committee

James Mullen, *Washington State Emergency Management Division, Co-Chair*

Dave Norman,* *Washington State Department of Natural Resources, Co-Chair*

Stacy Bartoletti,* *Structural Engineers Association of Washington, RWS Chair*

Tamra Biasco,* *Federal Emergency Management Agency*

Steve Boyer, *Hill and Knowlton, Private Industry Representative*

Tom Hill, *Washington Association of Building Officials*

Sheryl Jardine, *Washington State Emergency Management*

Scott Miles,* *Resilience Institute, Western Washington University*

Pat Morin, *Washington State Department of Transportation*

Bill Perkins, *American Society of Civil Engineers*

John Schelling,* *Washington State Emergency Management Division*

Barbara Thurman, *Office of the Superintendant of Public Instruction*

John Vidale, *State Seismologist, University of Washington*

Tim Walsh,* *Washington State Department of Natural Resources*

Craig Weaver, *United States Geological Survey*

WASHINGTON STATE
Seismic Safety Committee
Emergency Management
Council

Resilient Washington State

Process and Timing:

- 2008 – Seismic Safety Committee Revitalized
- 2009 – RWS Committee Formed
- 2010 – RWS Committee Developed Framework
- 9/17/2010 – Stakeholder Workshop 1 to form Sector Groups
- 12/2/2011 – Stakeholder Workshop 2 to learn about & deconflict Sector Group results/interdependencies
- 1-4/2012 – Review/Analyze Group Recommendations
- 6/30/2012 – Initial Draft Report Circulated
- 11/30/2012 – Final Draft Report Completed

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Resilient Washington State

- Modeled after city level assessment completed by San Francisco Urban Planning & Research Association
- *Purpose & Timeframe:*
  - Provide a framework for improving Washington's resilience when earthquakes occur.
    - Framework includes more effective seismic mitigation policies and recommendations for legislation and policy changes to improve and enhance statewide seismic safety.
  - Goal of making the state resilient ***over the next 50 years.***
- WA SSC state-level model replicated in Oregon as the "Oregon Resilience Plan"

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What is a Resilient Washington State?

Definition of a Resilient Washington State:

> *"A resilient state is one that maintains services and livelihoods after an earthquake. In the event that services and livelihoods are disrupted, recovery occurs rapidly, with minimal social disruption, and results in a new and better condition."*
>
> *- RWS Subcommittee*

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Resilient Washington State Values

Life Safety and Human Health:

No life-threatening injuries from earthquake-induced damage or serious illness from lack of emergency medical care. Includes enforcing and updating building codes, eliminating non-structural hazards, and ensuring continuity of emergency health care.

Property Protection:

Public and private property built, retrofitted, or rebuilt to minimize earthquake-induced damage. Includes both structural and non-structural elements.

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Economic Security:

Access to income opportunities to meet basic needs before and soon after EQ. Includes employment, market access, distribution capacity, and supplier access.

Environmental Quality:

Natural resources and ecosystems should be managed to minimize earthquake-induced damage. Includes growth management, accident response capacity, and industrial safety.

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Community Continuity:

Communities should have capacity to maintain social networks and livelihoods after an earthquake. Includes prevention of social-network disruption, social discrimination, and community bias.

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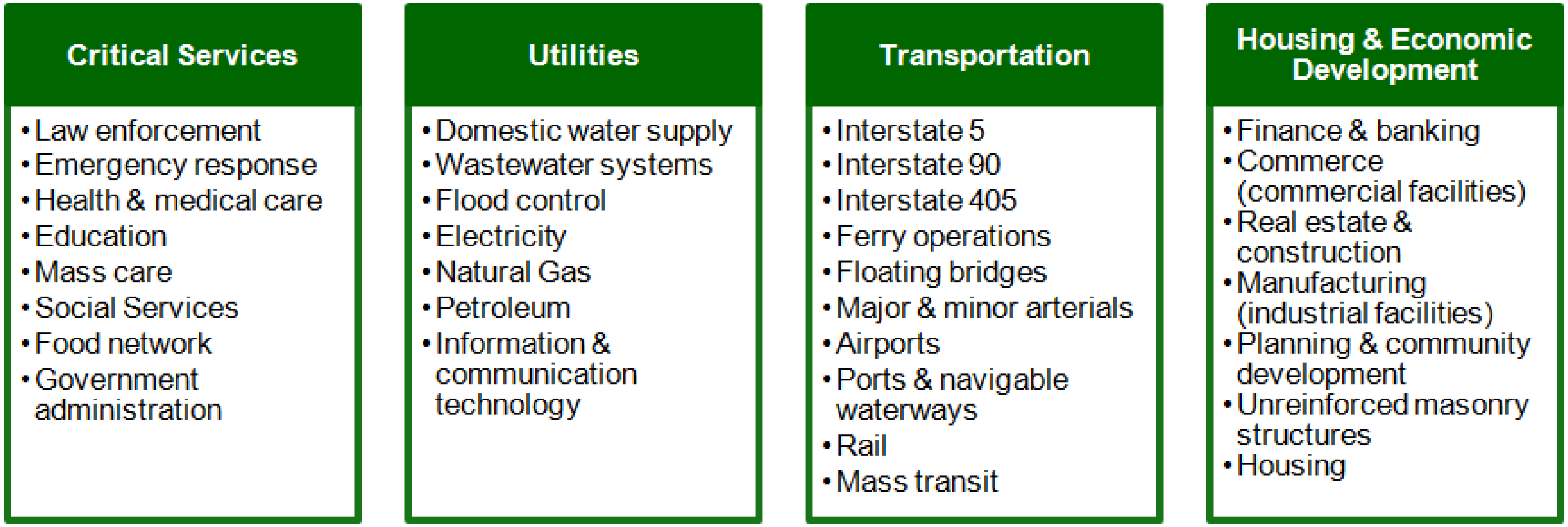
Four Sector Groups:



Critical Services

- Law enforcement
- Emergency response
- Health & medical care
- Education
- Mass care
- Social Services
- Food network
- Government administration

Utilities

- Domestic water supply
- Wastewater systems
- Flood control
- Electricity
- Natural Gas
- Petroleum
- Information & communication technology

Transportation

- Interstate 5
- Interstate 90
- Interstate 405
- Ferry operations
- Floating bridges
- Major & minor arterials
- Airports
- Ports & navigable waterways
- Rail
- Mass transit

Housing & Economic Development

- Finance & banking
- Commerce (commercial facilities)
- Real estate & construction
- Manufacturing (industrial facilities)
- Planning & community development
- Unreinforced masonry structures
- Housing

Figure 1. The four sector groups and their components. Each sector group was chaired by one member of the Resilient Washington State Subcommittee and one volunteer from within the sector.

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Objectives for the Sector Groups:

- Evaluate the current condition Sector and assess how quickly they can be restored.
- Develop targets for the desired restoration time frame.
- Define the vulnerabilities and key interdependencies.
- Prepare recommendations for statewide action to achieve desired targets.

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Earthquake Hazard:

- Not possible to define single EQ scenario at a State level.

- Identified a suite of scenarios from the 20 scenario earthquakes developed in 2009 by personnel from the WA EMD, WA DNR, USGS, and FEMA for use in planning efforts.

  - EQ Scenario Catalog: www.dnr.wa.gov

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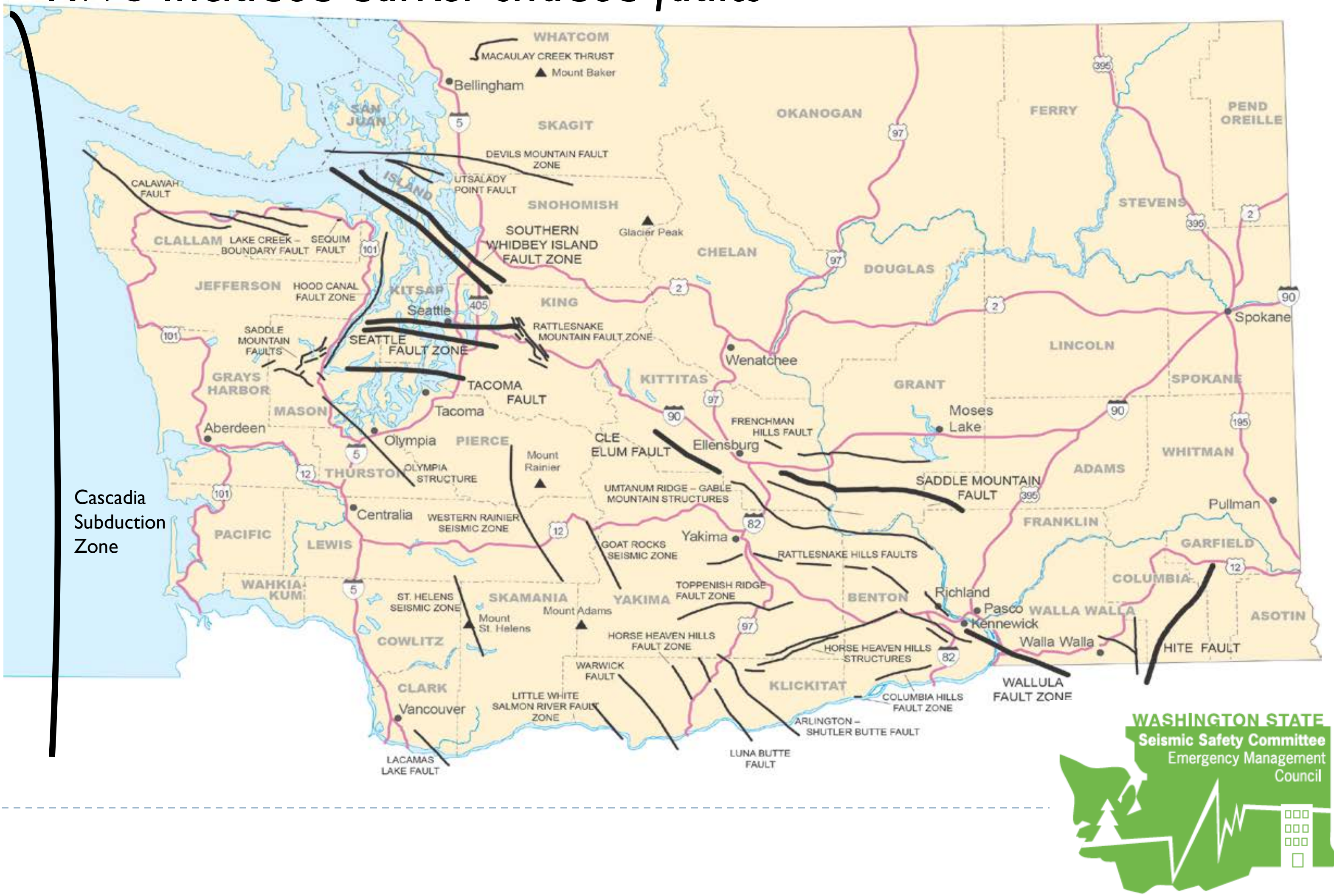
Earthquake Faults in Washington State:

RWS Included darker shaded faults



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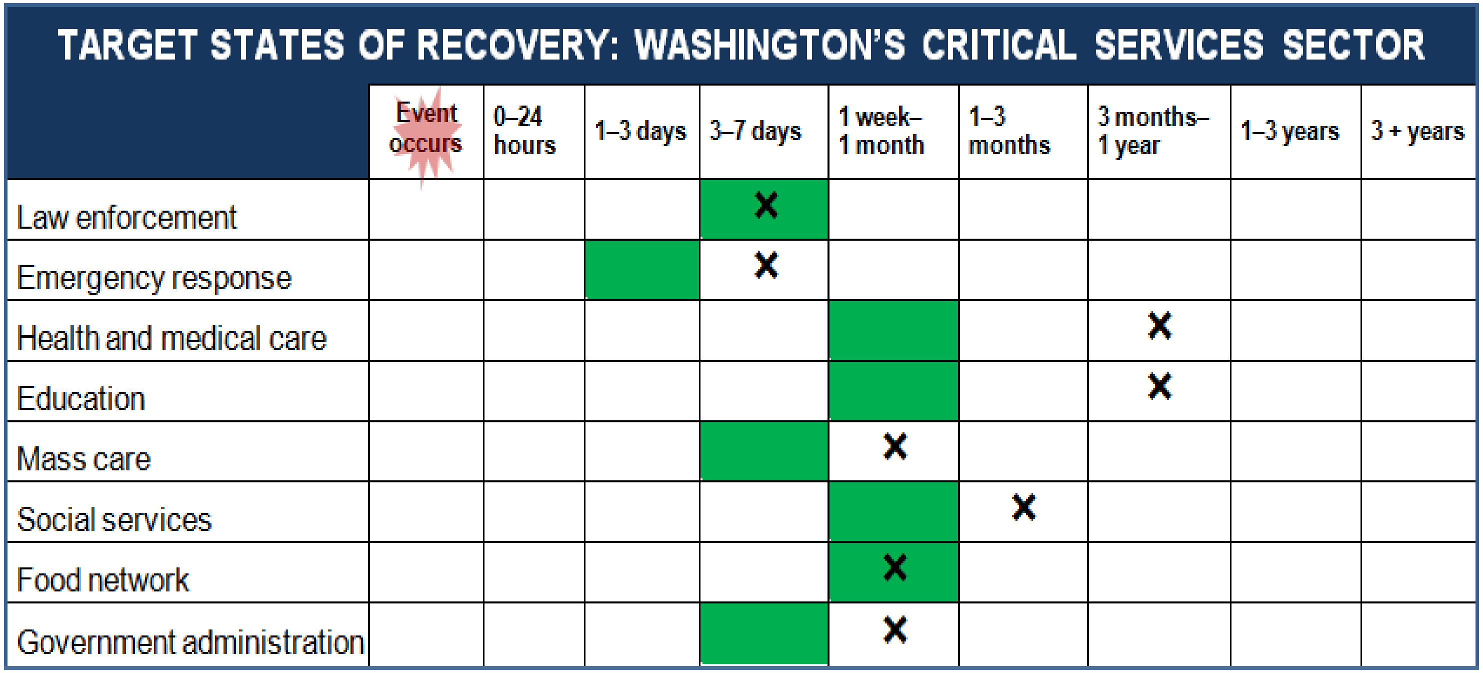
Critical Services



TARGET STATES OF RECOVERY: WASHINGTON'S CRITICAL SERVICES SECTOR

	Event occurs	0–24 hours	1–3 days	3–7 days	1 week–1 month	1–3 months	3 months–1 year	1–3 years	3 + years
Law enforcement				🟩 X					
Emergency response			🟩	X					
Health and medical care					🟩		X		
Education					🟩		X		
Mass care				🟩	X				
Social services					🟩	X			
Food network					🟩 X				
Government administration				🟩	X				

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Utilities

TARGET STATES OF RECOVERY: WASHINGTON'S UTILITIES SECTOR

	Event occurs	0–24 hours	1–3 days	3–7 days	1 week–1 month	1–3 months	3 months–1 year	1–3 years	3+ years
Domestic water supply									
Supply & transmission pipes			🟩	**NL**			**L**		
Distribution pipes			🟩		**NL**		**L**		
Wastewater systems									
Treatment facilities					🟩	**NL**	**L**		
Sewer pipes					🟩	**NL**		**L**	
Flood control									
Dams					🟩	✕			
Levees					🟩			✕	
Electricity									
Transmission					🟩			✕	
Distribution, 60% restored					🟩 ✕				
Distribution, 70% restored					🟩	✕			
Distribution, >70% restored					🟩		✕		
Natural Gas									
Transmission			🟩 **NL**		**L**				
Distribution, 40% restored					🟩 ✕				
Distribution, 90% restored					🟩	✕			
Petroleum									
Refineries & transmission					🟩			✕	
Distribution				🟩		✕			
Information and communication technology				🟩		✕			

KEY TO THE TABLE

TARGET TIMEFRAME FOR RECOVERY:

Operational (time it ought to take to restore component to 80–90% operational):	🟩
TIME NEEDED FOR RECOVERY TO 80–90% OPERATIONAL GIVEN CURRENT CONDITIONS:	✕
TIME NEEDED FOR RECOVERY TO 80–90% OPERATIONAL IN LIQUEFACTION ZONES GIVEN CURRENT CONDITIONS:	**L**
TIME NEEDED FOR RECOVERY TO 80–90% OPERATIONAL IN NON-LIQUEFACTION ZONES GIVEN CURRENT CONDITIONS:	**NL**

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Transportation

TARGET STATES OF RECOVERY: WASHINGTON'S TRANSPORTATION SECTOR

	Event occurs	0–24 hours	1–3 days	3–7 days	1 week–1 month	1–3 months	3 months–1 year	1–3 years	3+ years
Interstate 5									
Puget Sound (center & north)				🟥	🟨	🟩		✕	
South end (Chehalis south)			🟥	🟨	🟩		✕		
Interstate 90									
Puget Sound (Snoqualmie Pass west)				🟥	🟨	🟩		✕	
Cascades to eastern WA (Snoqualmie to Idaho)			🟥	🟨	🟩		✕		
Interstate 405									
South end (Tukwila to I-90)			🟥	🟨		🟩		✕	
North end (I-90 to Lynnwood)				🟥	🟨	🟩		✕	
Ferry operations		🟥		🟨	🟩		✕		
Floating Bridges									
SR 520				🟥	🟨	🟩		✕	
I-90			🟥	🟨	🟩		✕		
Hood Canal		🟥	🟨	🟩	✕				

KEY TO THE TABLE

TARGETS TO ACHIEVE DIFFERENT LEVELS OF RECOVERY:

Minimal *(A minimum level of service is restored, primarily for the use of emergency responders, repair crews, and vehicles transporting food and other critical supplies.)*	🟥
Functional *(Service is not yet restored to full capacity, but is sufficient to get the economy moving again—e.g. some truck/freight traffic can be accommodated. There may be fewer lanes in use, some weight restrictions, and lower speed limits.)*	🟨
Operational *(Restoration is up to 80–90% of capacity: A full level of service has been restored and is sufficient to allow people to commute to school and to work.)*	🟩
TIME NEEDED FOR RECOVERY TO 80–90% OPERATIONAL GIVEN CURRENT CONDITIONS:	✕

For a number of components, the timeframes marked in the table reflect the estimated recovery period following a worst case scenario earthquake. See the notes in Workshop Report II for details.

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Transportation (cont.)

TARGET STATES OF RECOVERY: WASHINGTON'S TRANSPORTATION SECTOR (CONTINUED)

	Event occurs	0–24 hours	1–3 days	3–7 days	1 week–1 month	1– 3 months	3 months–1 year	1– 3 years	3+ years
25% of major & minor arterials		🟥	🟨	🟩	✕				
50% of major & minor arterials		🟥		🟨	🟩	✕			
75% of major & minor arterials			🟥	🟨		🟩	✕		
90% of major & minor arterials			🟥		🟨		🟩	✕	
Airports		🟥		🟨	🟩			✕	
Airport for emergency traffic		🟨			✕				
Ports and navigable waterways				🟥	🟨	🟩		✕	
Rail (freight & passenger)				🟥	🟨	🟩		✕	
Mass transit: estimates mirror those of major & minor arterials									

KEY TO THE TABLE

TARGETS TO ACHIEVE DIFFERENT LEVELS OF RECOVERY:

Minimal *(A minimum level of service is restored, primarily for the use of emergency responders, repair crews, and vehicles transporting food and other critical supplies.)*	🟥
Functional *(Service is not yet restored to full capacity, but is sufficient to get the economy moving again—e.g. some truck/freight traffic can be accommodated. There may be fewer lanes in use, some weight restrictions, and lower speed limits.)*	🟨
Operational *(Restoration is up to 80–90% of capacity: A full level of service has been restored and is sufficient to allow people to commute to school and to work.)*	🟩
TIME NEEDED FOR RECOVERY TO 80–90% OPERATIONAL GIVEN CURRENT CONDITIONS:	✕

For a number of components, the timeframes marked in the table reflect the estimated recovery period following a worst case scenario earthquake. See the notes in Workshop Report II for details.

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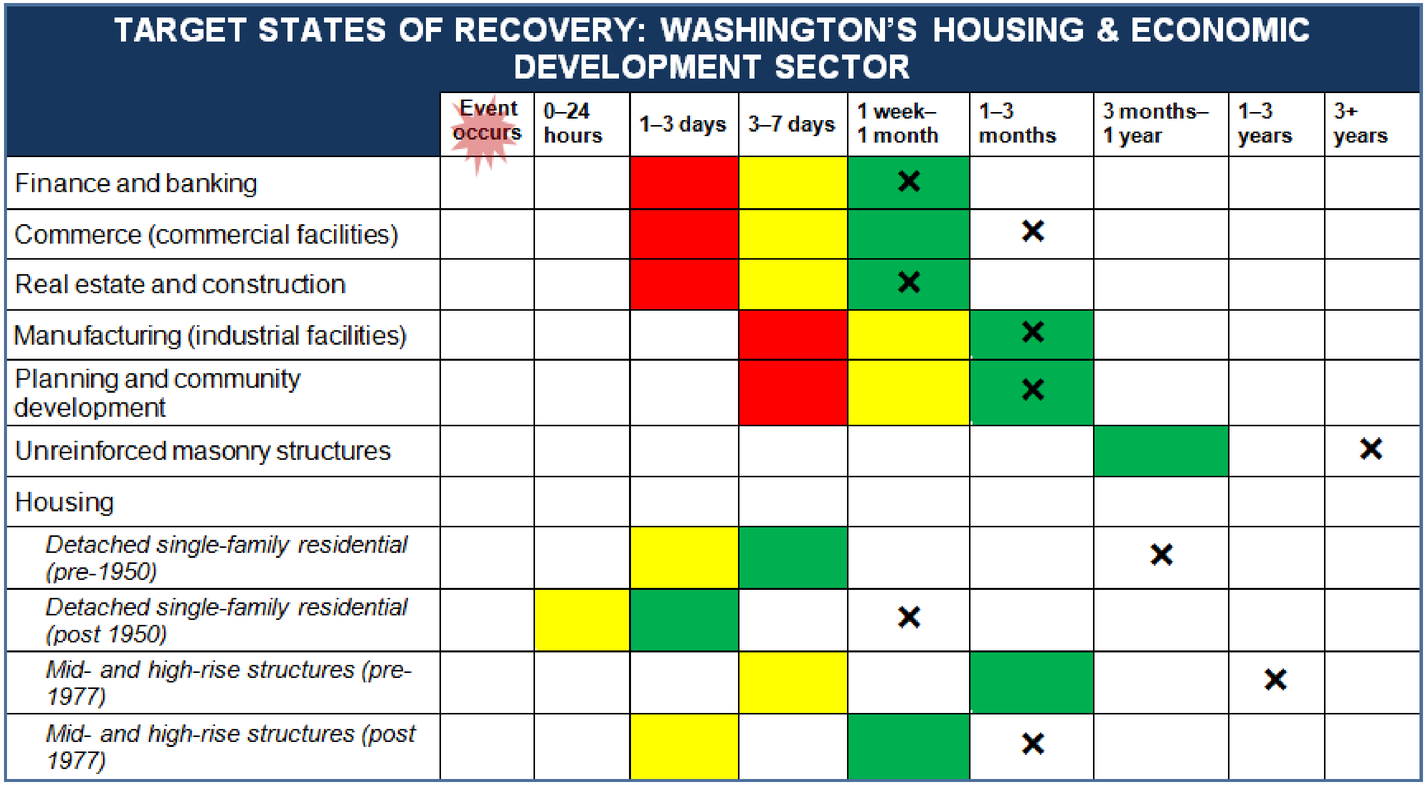
Housing & Economic Development



TARGET STATES OF RECOVERY: WASHINGTON'S HOUSING & ECONOMIC DEVELOPMENT SECTOR

	Event occurs	0–24 hours	1–3 days	3–7 days	1 week–1 month	1–3 months	3 months–1 year	1–3 years	3+ years
Finance and banking			🟥	🟨	🟩 ✕				
Commerce (commercial facilities)			🟥	🟨	🟩	✕			
Real estate and construction			🟥	🟨	🟩 ✕				
Manufacturing (industrial facilities)				🟥	🟨	🟩 ✕			
Planning and community development				🟥	🟨	🟩 ✕			
Unreinforced masonry structures							🟩		✕
Housing									
Detached single-family residential (pre-1950)			🟨	🟩			✕		
Detached single-family residential (post 1950)		🟨	🟩		✕				
Mid- and high-rise structures (pre-1977)				🟨		🟩		✕	
Mid- and high-rise structures (post 1977)			🟨		🟩	✕			

KEY TO THE TABLE

TARGETS TO ACHIEVE DIFFERENT LEVELS OF RECOVERY:

Minimal:	🟥
Functional:	🟨
Operational (time it ought to take to restore component to 80–90% operational):*	🟩
TIME NEEDED FOR RECOVERY TO 80–90% OPERATIONAL GIVEN CURRENT CONDITIONS:	✕

For a number of components, the timeframes marked in the table reflect the estimated recovery period following a worst case scenario earthquake.

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Resilience Recommendations

Recommendations are predicated upon the following:

1. Mitigation activities should be incentivized to the greatest degree possible – buying down tomorrow’s risk at today’s rates
2. Use earthquake & tsunami mitigation activities to:
    - create jobs;
    - stimulate economy;
    - reduce unemployment; and
    - reduce risk to people, property, the economy, and the environment
3. Leverage potential private sector investments to off set costs to state and citizens.

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Ten Resilience Recommendations:

1. Make schools resilient: structurally, socially, and educationally.
2. Require that utility providers identify the vulnerabilities in their systems and mitigate the deficiencies.
3. Improve the resilience of buildings in areas of high seismic hazard to improve life safety and increase the number of people who will be able to shelter in place.
4. Assess the permitting requirements that relate to environmental protection and mitigation to determine how best to make environmental planning mesh with seismic mitigation and recovery planning.
5. Strengthen business continuity planning efforts.

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Ten Resilience Recommendations:

6. Strengthen regional transportation networks.

7. Make hospitals resilient—structurally and functionally.

8. Identify and map in greater detail sources of seismicity and geologically hazardous areas and develop plans for mitigation of identified hazards.

9. Improve life safety in coastal communities at risk of local tsunamis.

10. Implement resilience principles through formalized accountability.

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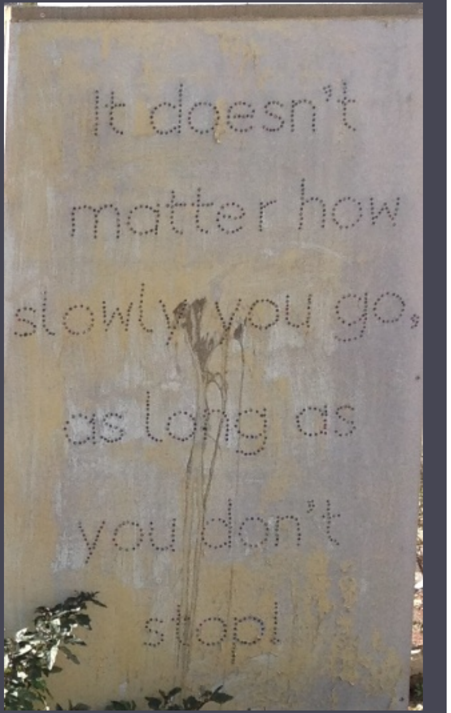
Read the full report at: www.emd.wa.gov on the SSC page

With every disaster comes opportunity.



Will we seize our opportunities to create a better, more resilient Washington ***before*** or ***after*** our next big earthquake(s)?